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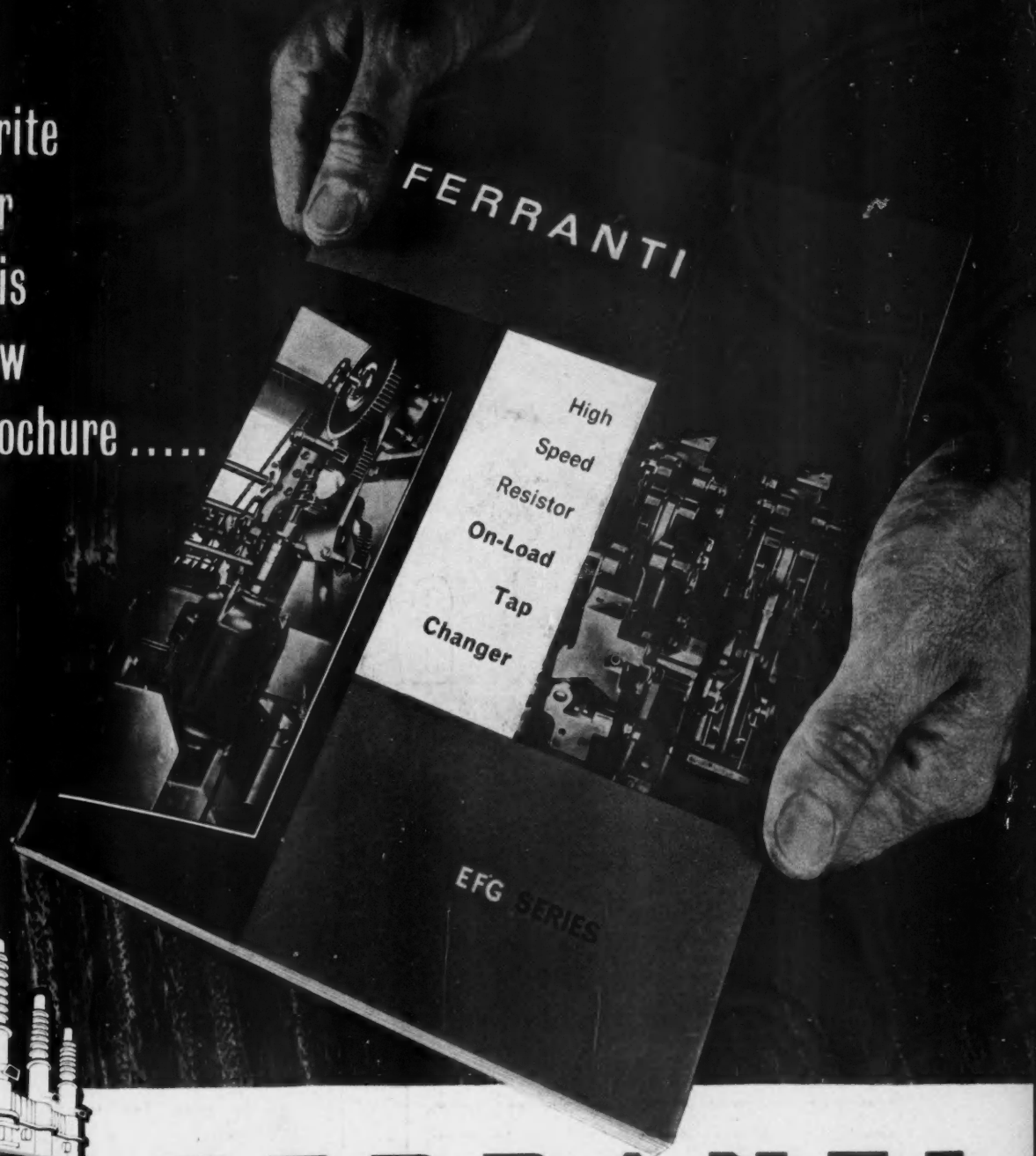

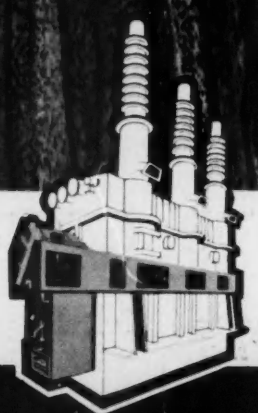

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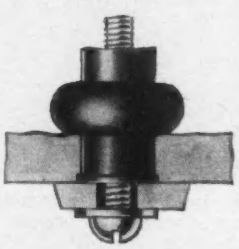	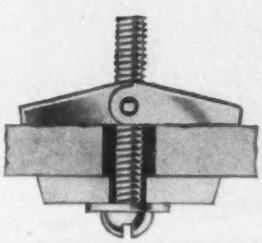	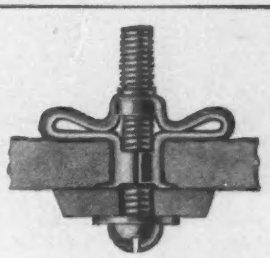

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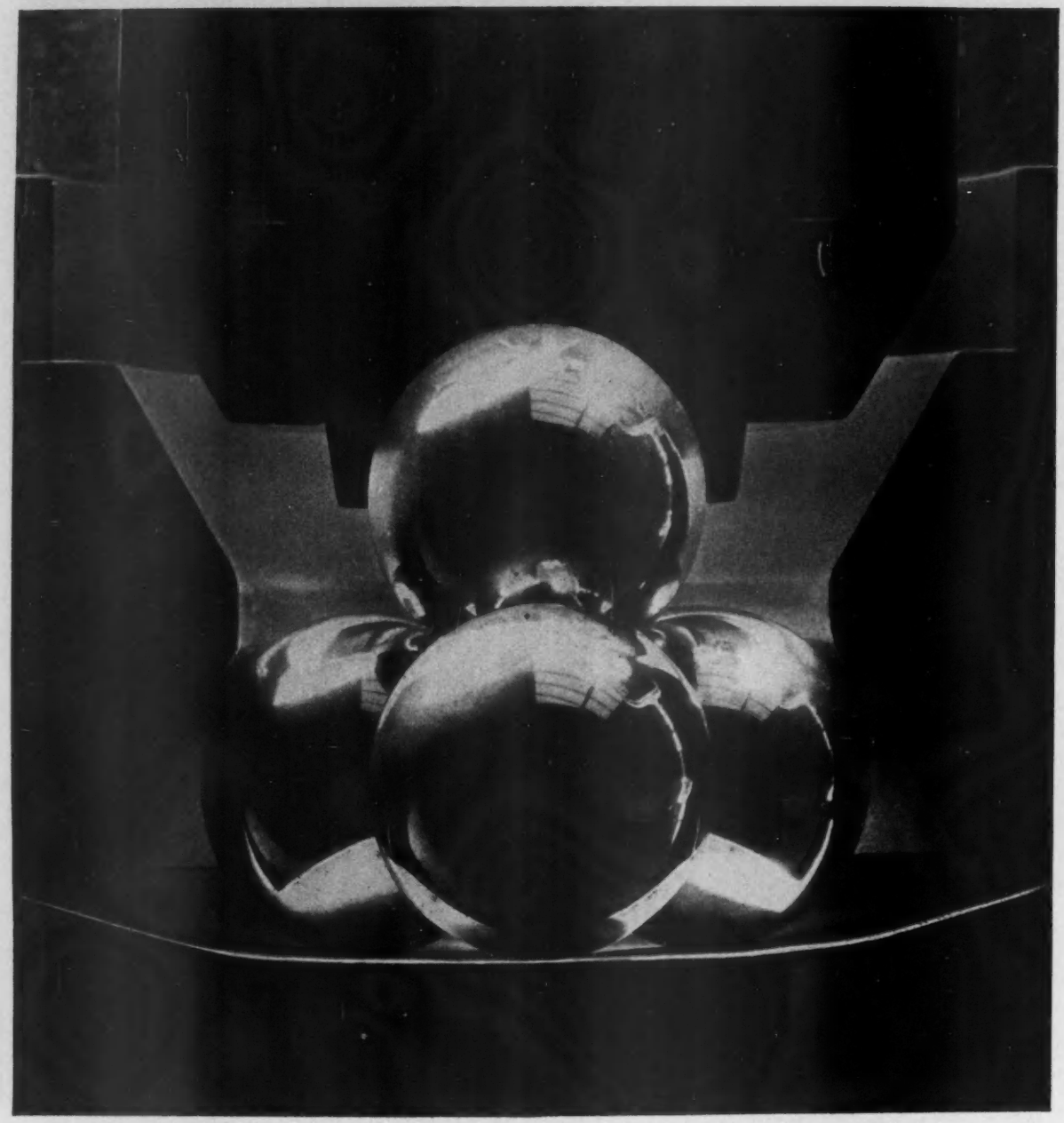

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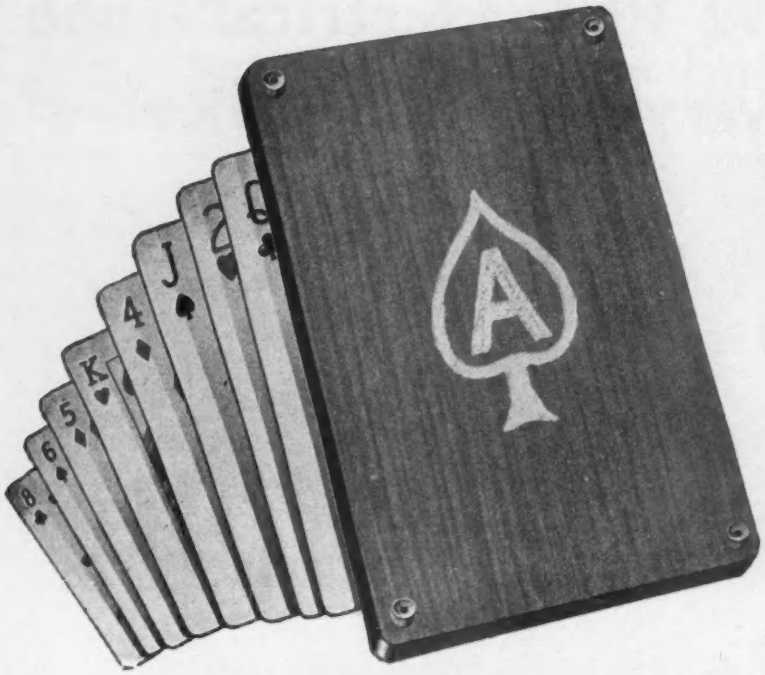

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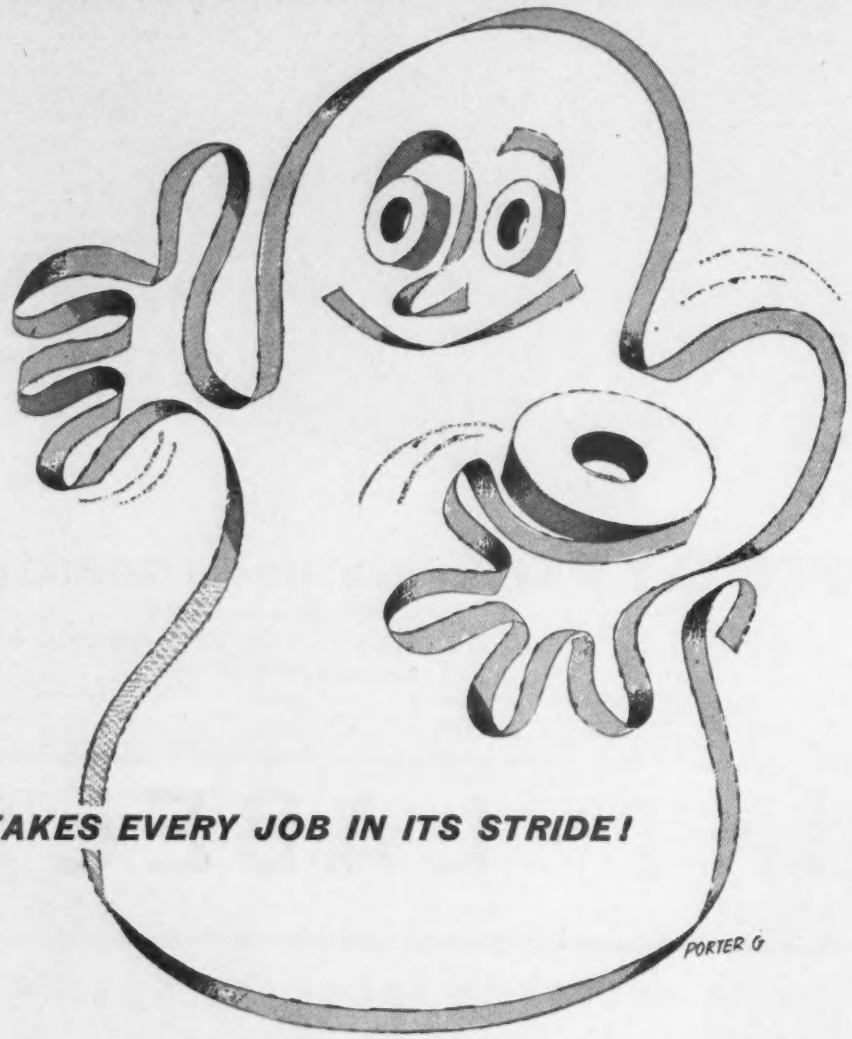

YET IT TAKES EVERY JOB IN ITS STRIDE!

Lasso No. 92 has so many properties, so many uses, we could fill this page with them. And dull reading it would make. A lot of stuff about pliability, water resistance, acid resistance, wrapping, jointing, insulating, binding, splicing — *that* sort of thing. Far better send for our alert young representative, *he* makes it sound interesting. Ask your secretary to drop us a line today.

SEND TODAY FOR OUR WALKIN', TALKIN', THINKIN' REP

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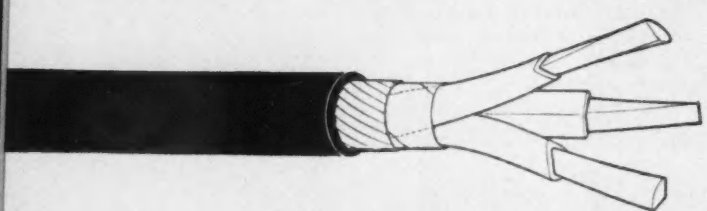
Solidal—the insulated cable with conductor cores of solid aluminium—is light, compact and cheap. It is readily manipulated and easy to lay and joint. Now available from leading cable makers, Solidal offers real economic advantages. Its design and development are an example of the forward thinking and research resources of Alcan, which could be of help to you too. If you have a problem that aluminium might solve, why not get in touch with your nearest Alcan office?



COMPACT, LIGHT AND EASY TO JOINT

the solid sector-shaped conductor cores are of extruded aluminium each insulated by appropriately coloured PVC, the whole is lapped with clear tape. Outside this, a single layer of rectangular, hard aluminium wire is wound, serving the double purpose of armour and neutral. Over all is extruded the outer sheath of PVC. Solidal was developed by Alcan.

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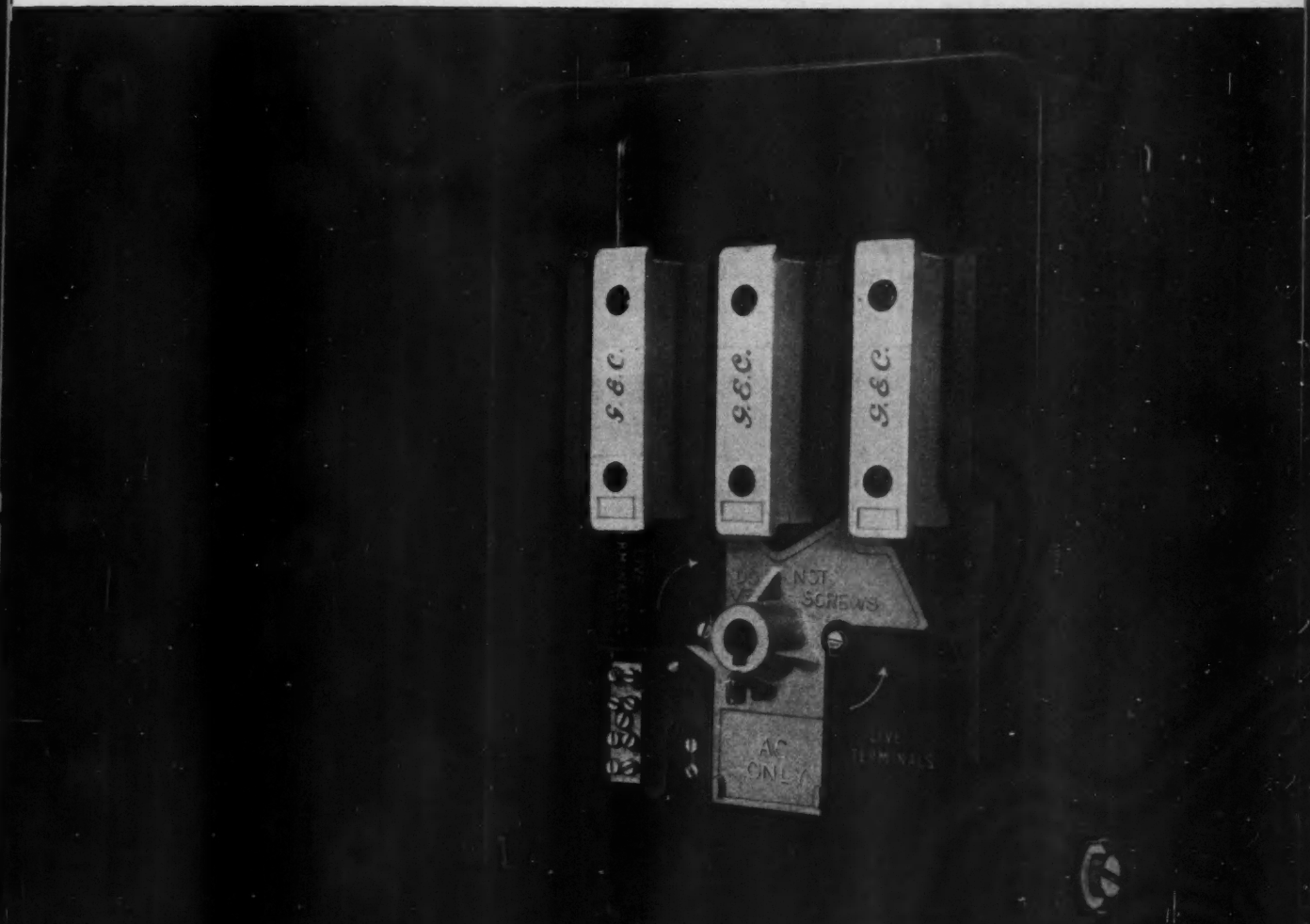
***IMMEDIATE DELIVERY** of 'Hidutac' switchfuses from wholesalers throughout the country. For more detailed information ask your wholesaler for 'Hidutac' literature.*



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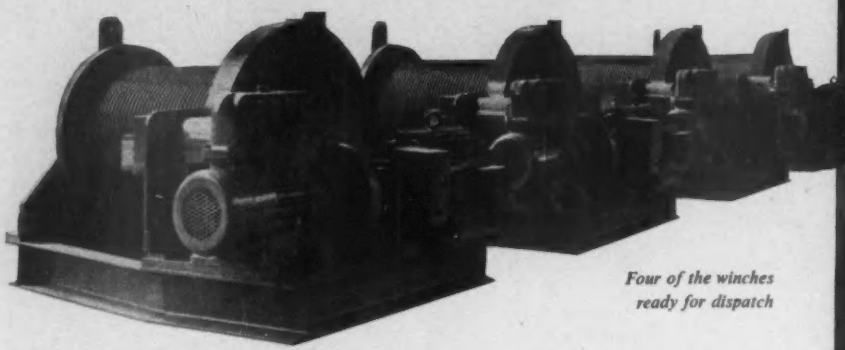
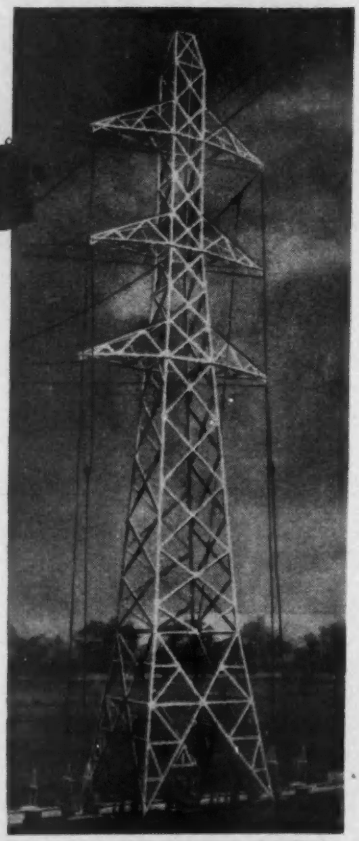


Four of the winches ready for dispatch



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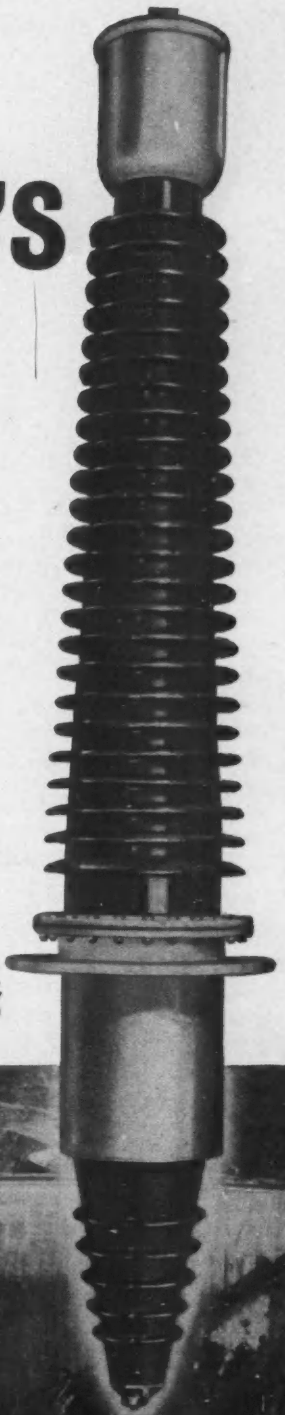

A complete 330 kV. bushing insulator (by courtesy of A.E.I. Ltd.)

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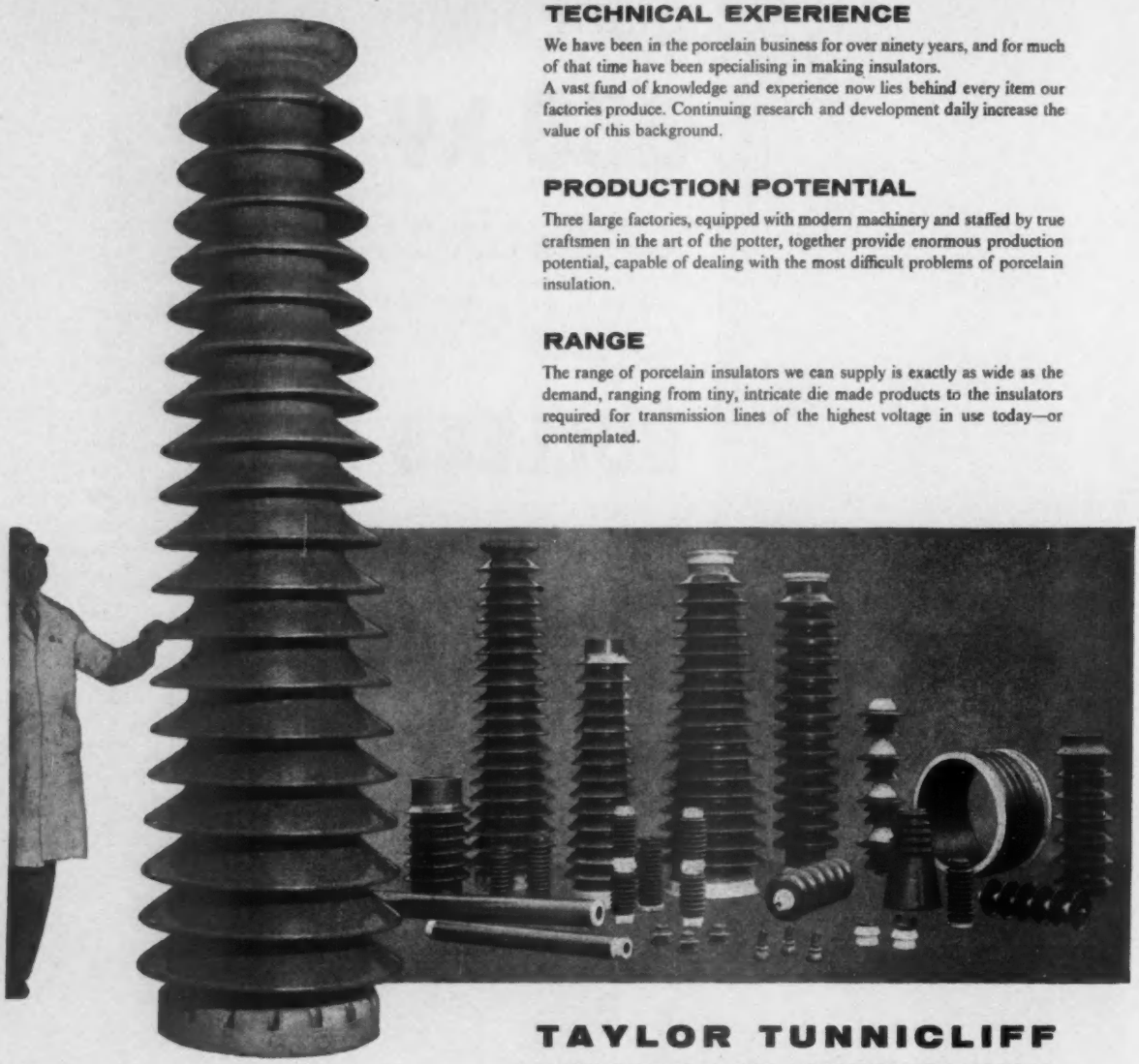

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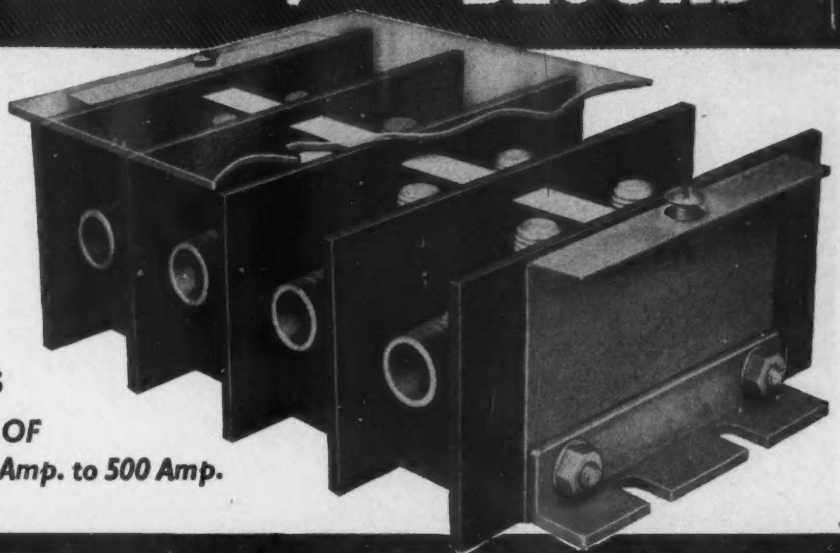

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Few cuts in nationalised industry investment, promises Chancellor of Exchequer defending economy measures in Commons. Investment to match existing programmes and provide essential supplies and services to be permitted, other investment restricted. (143)

Most appliance makers pass on the 10% purchase tax surcharge, Hotpoint and Prestcold refrigerators and most of Morphy-Richards 'fridges are amongst exceptions. (165)

Minimum socket-outlet provisions proposed for Scottish housing in draft regulations under Building (Scotland) Act. Sixteen outlets for three-bedroom house; must be 13 A design. Wiring to conform effectively to IEE standards; lighting and heating requirements included. (143, 162)

BEAMA form new Electronics Board to act for Association on matters of broad policy; will not cover telecommunications or components. (163)

650 MW cross-compound set at US Paradise station scheduled for commissioning in Sept. 1962, with computer controlled 4,900 klb/hr cyclone boilers, described in American Power Conference papers. Supercritical units successful but not fully justified by capital cost judging by first operational year at Avon 8. High speed feed pumps predicted to replace conventional designs. (144, 151)

All thermal storage heaters will attract p.t. in September when Thermodare introduce new model for the home. No differentiation of tax possible depending on use. (144, 165)

NFEA cleared of attempt to dodge RP Court undertaking to abandon price agreement. Application for committal to prison of director L. C. Penwill for contempt of court rejected. (163)

New square fluorescent lamp in production in US. Two ratings, 80 W and 50 W, with 4,800 and 2,900 lumens output, to be marketed shortly. (147)

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US company bids for A. C. Cossor in cash offer of 7s 9d for 5s shares, subject to Treasury consent. Firm will continue as separate entity. (165)

PEOPLE—B. Feltbower joins English Electric as chief engineer, Control Gear Div . . . J. E. Smith succeeds Dr B. L. Goodlet (retiring) as managing director, Brush Elec. Engrg . . . A. J. Spraggons to be Southern district engineer, LEB . . . E. S. Holland promoted to general sales manager, "Servis" appliances . . . C. C. Knowles and J. D. Hood join William McGeoch board . . . S. G. Nimrod appointed chairman and managing director of Backer Electric . . . GEC appoint C. Dykes Brown group technical manager, lighting and heating group, and G. Gallety group marketing manager. (156, 158)

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Exhaustive works testing at every stage of manufacture ensures the safe and efficient dependability of SANDERS Switchgear, renowned for superb performance and lasting reliability. Excellence of design, high quality finish and the embodiment in every Sanders product of years of specialised experience are not enough. Every SANDERS Unit must pass the most stringent works tests with a comfortable margin. This way you can be sure – as we are – that SANDERS Switchgear will survive the most rigid of all tests for dependability, that of continuous loading in daily use. Space-saving compactness, simplicity, ease of wiring and installation and complete dependability are your guarantee that

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PEOPLE—B. Feltbower joins English Electric as chief engineer, Control Gear Div . . . J. E. Smith succeeds Dr B. L. Goodlet (retiring) as managing director, Brush Elec. Engrg . . . A. J. Spraggons to be Southern district engineer, LEB . . . E. S. Holland promoted to general sales manager, "Servis" appliances . . . C. C. Knowles and J. D. Hood join William McGeoch board . . . S. G. Nimrod appointed chairman and managing director of Backer Electric . . . GEC appoint C. Dykes Brown group technical manager, lighting and heating group, and G. Galletly group marketing manager. (156, 158)

NEWS SHEET

Improved static frequency tripler incorporates auto-voltage control. Grain oriented magnetic materials and flux turn linkage saturated at 60° electrical, enables higher output voltages and better waveforms in 3 kW to 4 kW experimenta tripler. (145)

Manweb to introduce inspection scheme for consumers' installations. 30s charge for domestic premises up to ten rooms, higher charges for farms and commercial. Written report of inspection to be given. (164)

ETU executive rejects TUC ultimatum to set house in order. Expulsion from TUC a possibility. (164)

Mutual inductance as a basis for transformer studies offers certain advantages argues R. A. Frewer. First necessity is establishment of simple convention for sign of mutual inductance. (148)

Whole of USSR will be electrified by 1980, says Khrushchev. Output must be raised to 1 thousand million MWh by 1970 and 2·7 to 3 thousand million MWh in following decade. (167)

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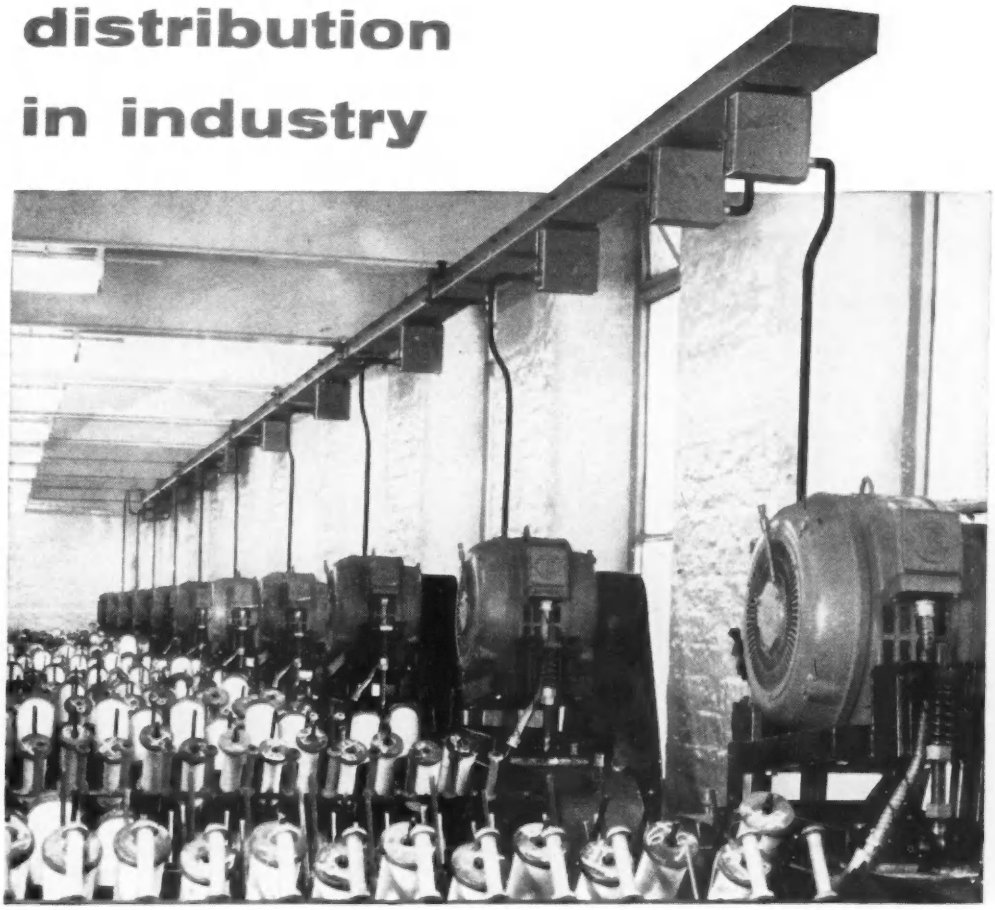
Plan for developing Dip.Tech. in London colleges published. Courses in electrical engineering at eight colleges with two more courses under consideration. (166)

BUSINESS—Richardsons, Westgarth's licence to manufacture Brown-Boveri thermal equipment terminated by mutual agreement . . . Metal Industries maintain 15%, with profit £64,000 below forecast . . . Higher sales by Ward and Goldstone for first quarter, and Colvern sales continue satisfactory . . . GEC expect to maintain 10% dividend in current year; Osram and most subsidiaries had better results . . . A. J. Flatley definitely going public next July . . . Electric Construction production up . . . Thorn earnings up by nearly £200,000 and dividend held at 25% . . . Better results from Oldham and Son and George Kent but Dubilier Condensers hit by TV recession . . . Wilkins and Mitchell cuts dividend by 9% . . . Lower profits for Westinghouse. (169, 170)

OVERSEAS—Mauritius to have two new h.e. schemes and 42 MW thermal station . . . Cape Town order further plant for Athlone extension . . . BICC get another £1 million railway electrification order from India . . . CEB of Malaya order 62 diesel sets of 28 kW for remote villages . . . Queensland not to seek World Bank finance for next power development. (168)

Overhead power distribution in industry



The spinning room of a textile factory equipped with 'ENGLISH ELECTRIC' OVERHEAD BUSBARS and textile motors.

'ENGLISH ELECTRIC' pioneered the overhead busbar system over 25 years ago to provide a safe, simple and reliable distribution system of power in factories.

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Standard lengths and plug-in-boxes are available ex stock, and special arrangements can be made to suit individual site requirements.

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Fusegear Division, East Lancashire Road, Liverpool, 10

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NEWS SHEET

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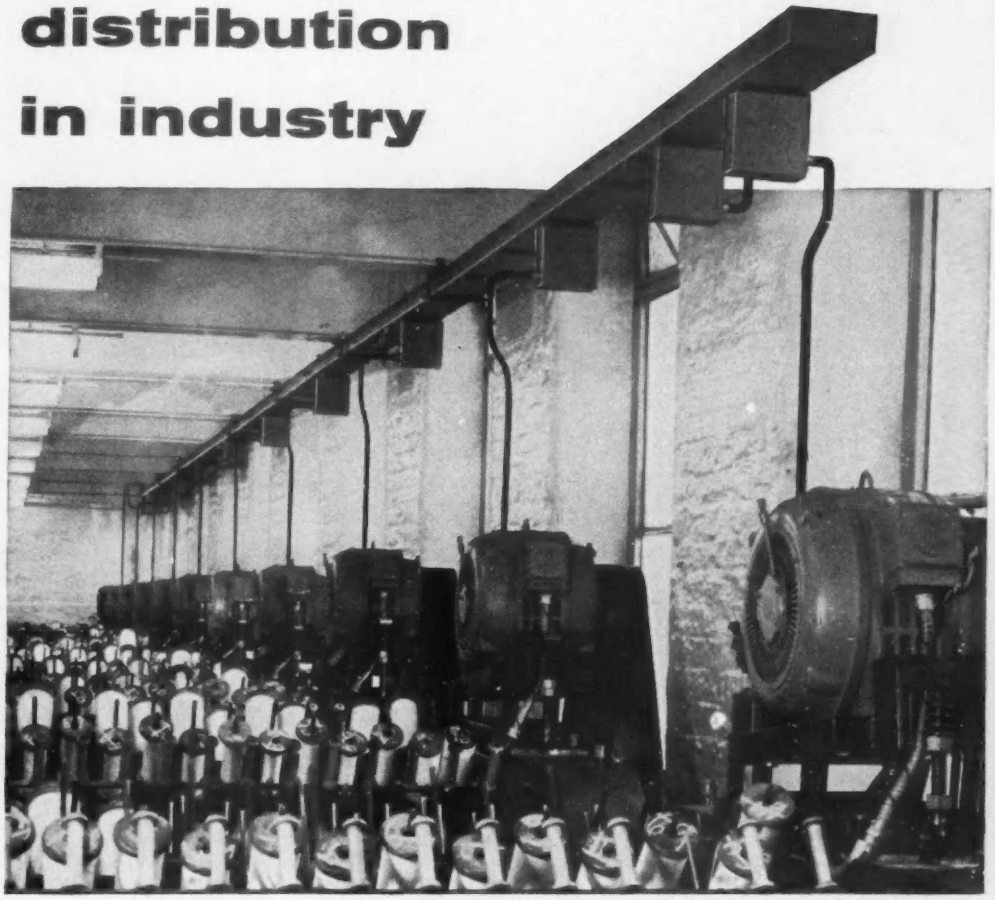

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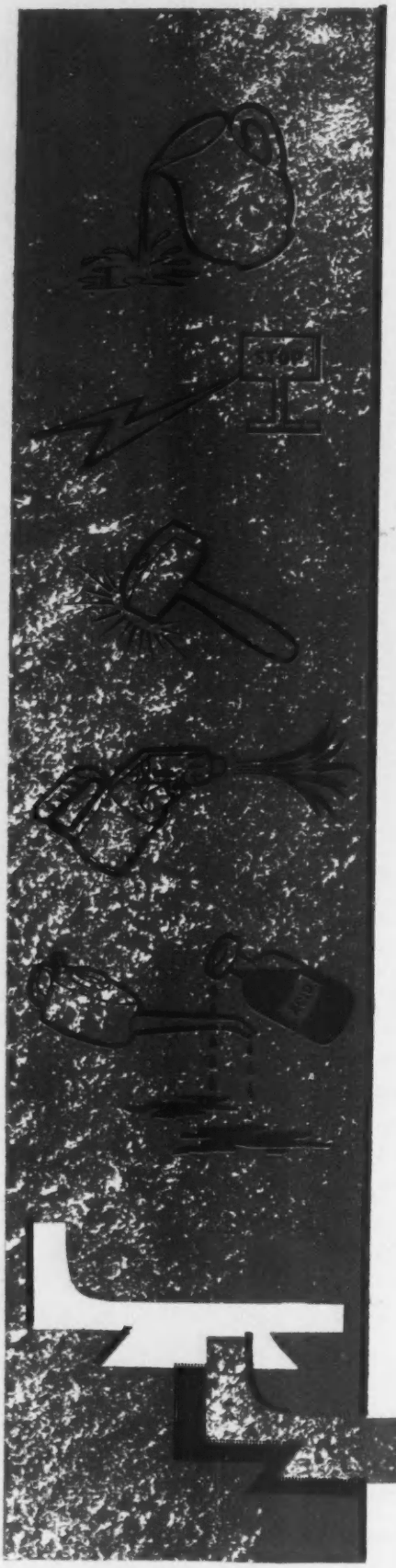

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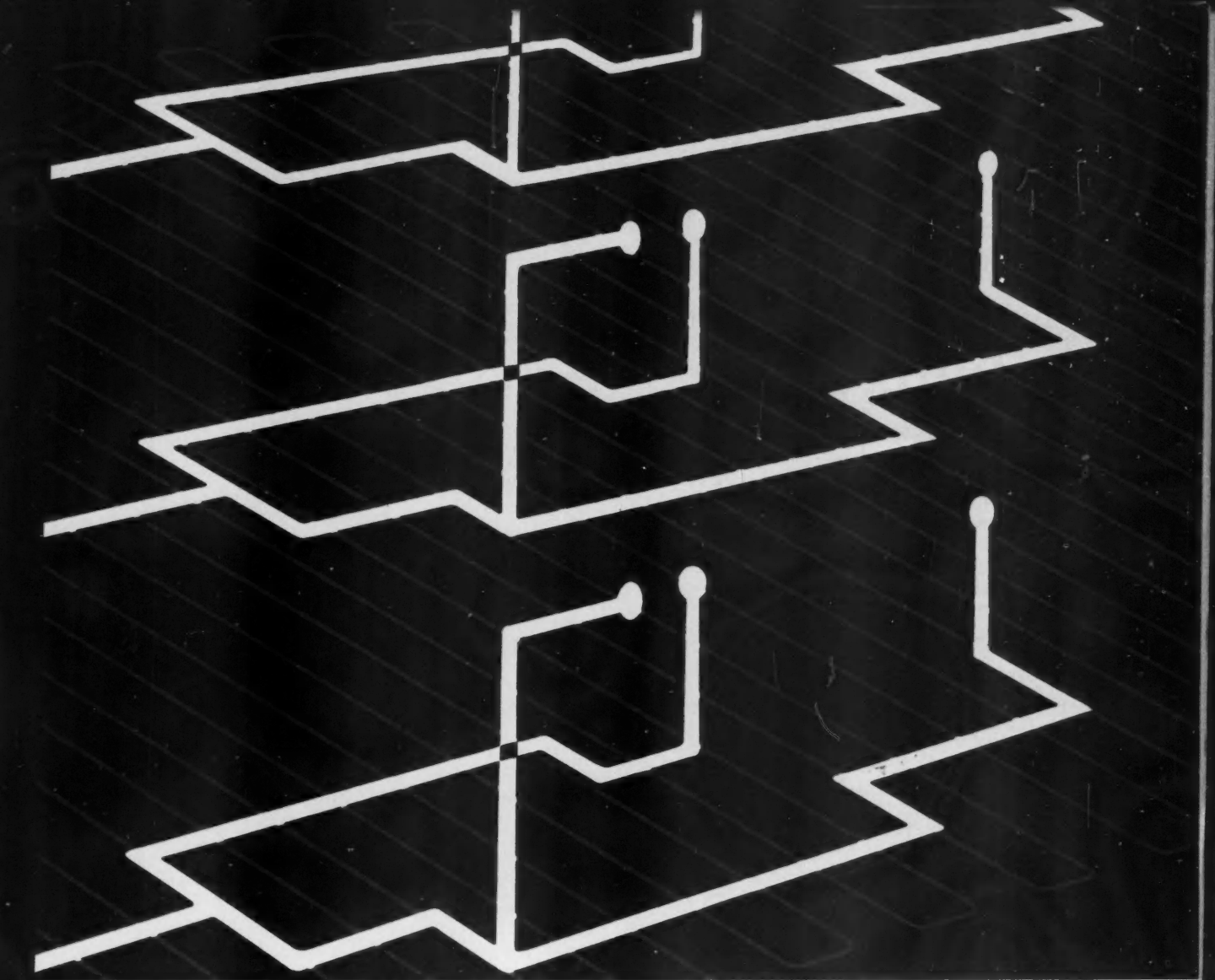

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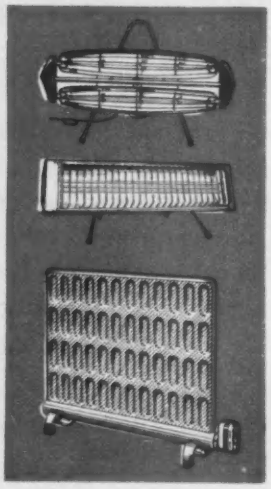

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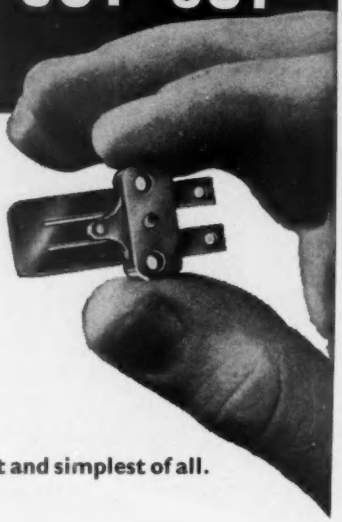

World Patents including Patent Numbers 600055, 622781, 624905, 657434, 713443, 749716, 774911, 782668, and others. Also other patents pending.

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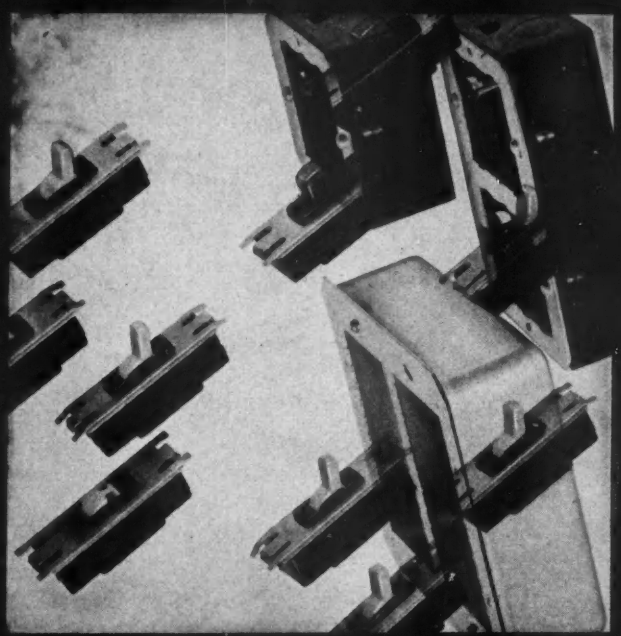

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INSTALLATION EQUIPMENT GROUP

G.E.C. Installation Equipment Group have a *new approach* to designing switches. Now you can fit any of the 11 interchangeable 'Mutac Clipper' switch units into just 3 different sizes of grids and boxes . . . for example, 3 switch units into a standard BS 1299 or plaster depth box. G.E.C.'s new approach makes 'Mutac Clipper' switches unrivalled for ease and speed of assembly . . . ensures that these precision-made, electronically-tested switches give a *guaranteed* long-life performance . . . takes the clicking out of switching.

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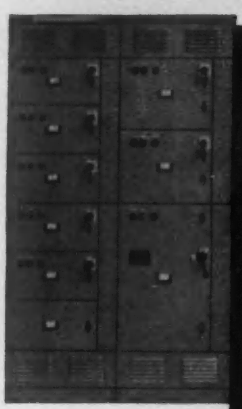
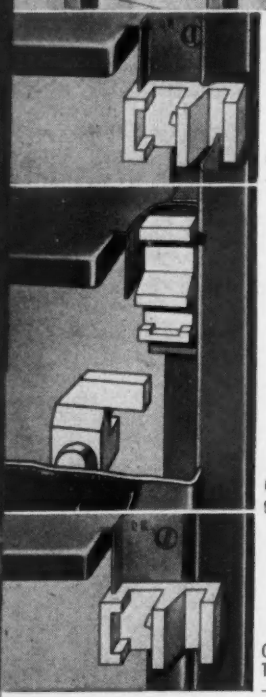


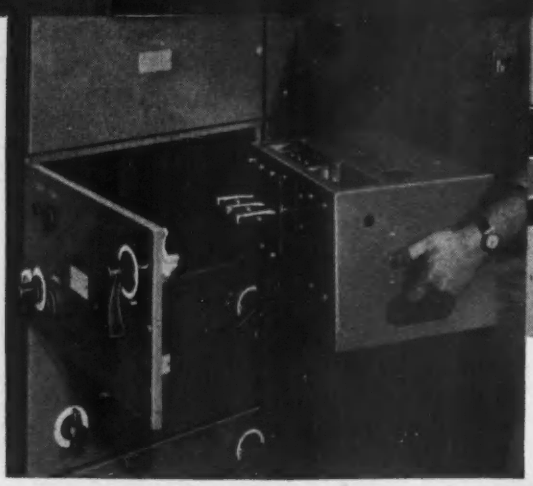
ALL THESE



ON – locked in – safe

OFF – tray free

ON – locked out Tray unplugged – safe



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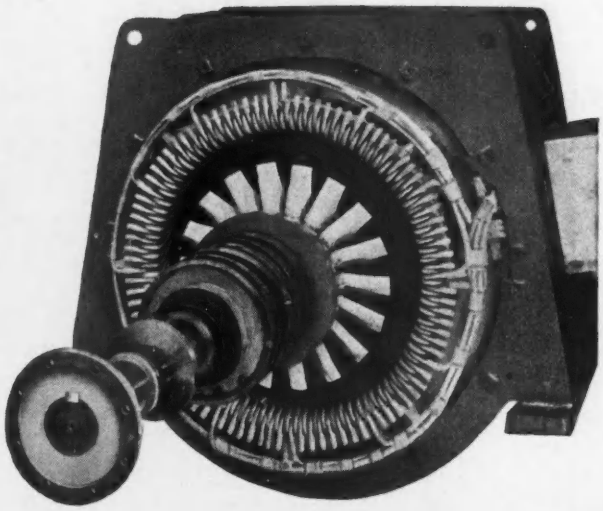
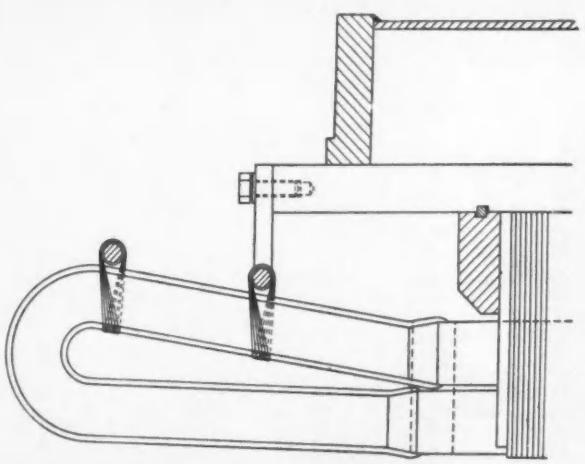


There comes a point in every design where the practical takes over from the theoretical. Up to this point all equipment of the same kind is—potentially at least—the same because theory is common ground. Beyond it success depends largely on experience; on having done the job many times before. It is here that the differences between motors with the same specified performance show up, and the word performance itself takes on the wider, vaguer, but essentially more realistic, meaning which includes those things—robustness, reliability, ease of maintenance—which an engineer has in mind when he thinks of a first-class job.

This thing called know-how



A very simple example of this essentially empirical approach is provided by the bracing and anchoring of the end windings of large A.C. motors. Many such machines are required to start direct-on-line or to have to deal with arduous braking duties. In these circumstances, the forces between coils are very considerable and the design of the end bracing is particularly important. It might well be thought that the windings would be most effectively braced at their outer ends, but experience has shown that this is not so. The forces are greatest about half way along the out hang and the greatest stability is achieved when a frame-anchored bracing ring is placed at this point. A further unanchored ring is fitted at the coil evolutes. It is in detail of this kind that a manufacturer's experience shows itself.

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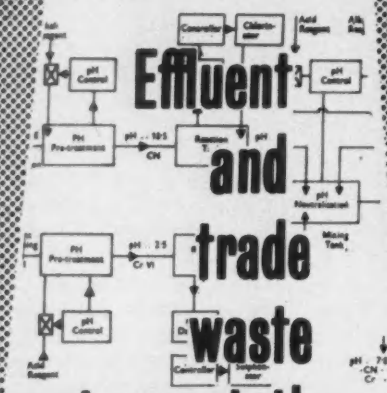
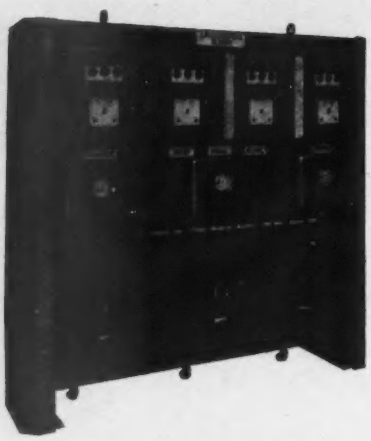


Effluent and trade waste instrumentation BY Lock



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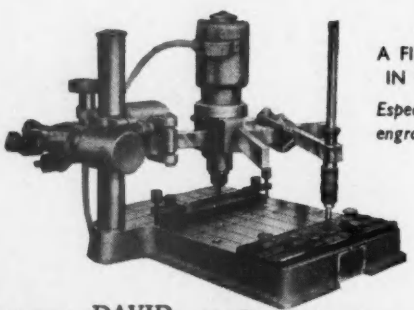

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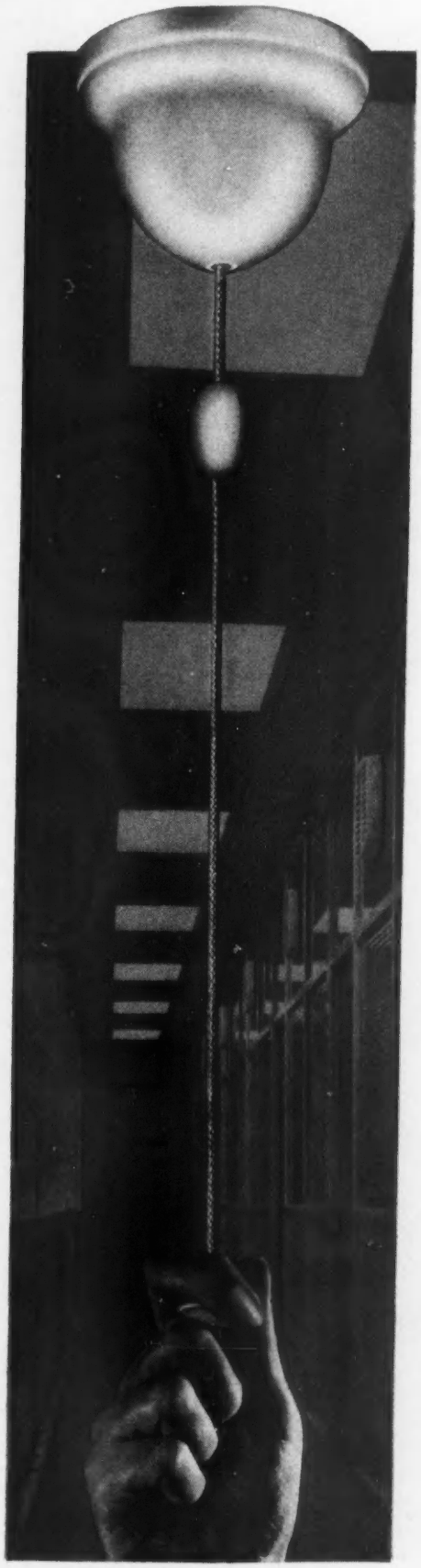

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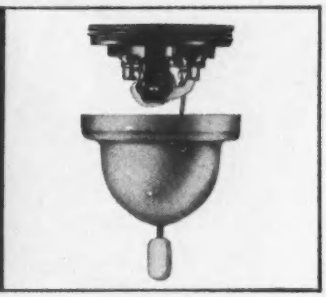

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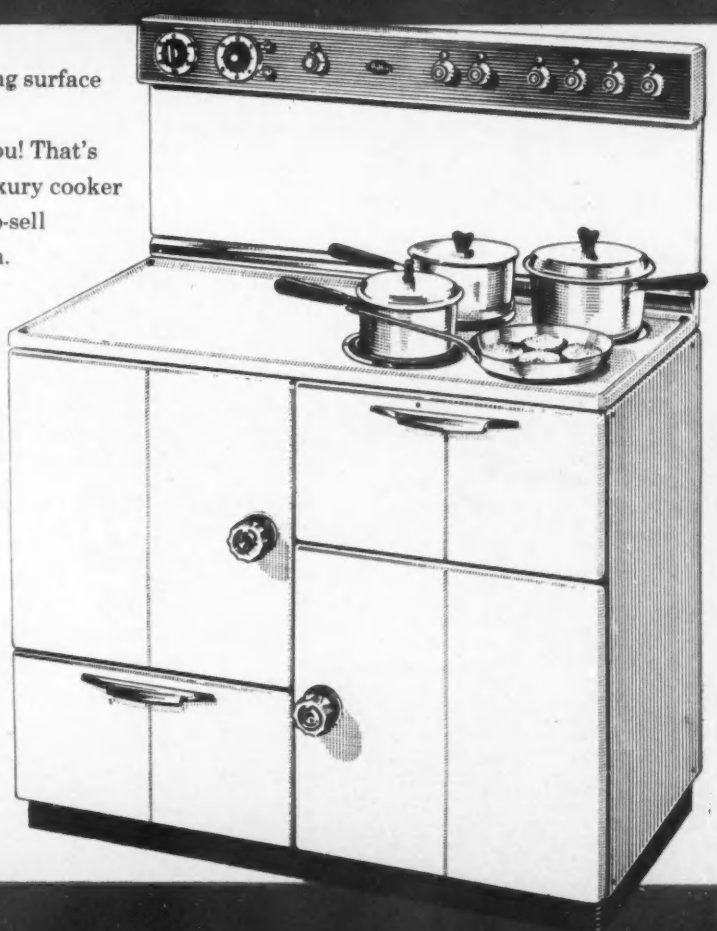

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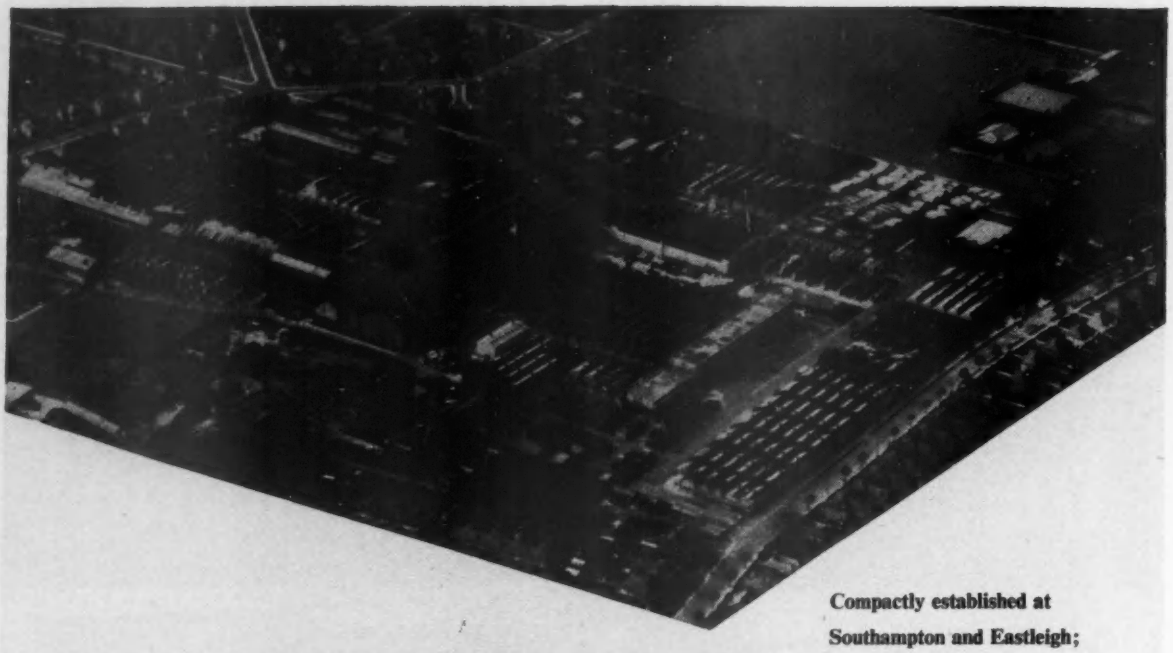

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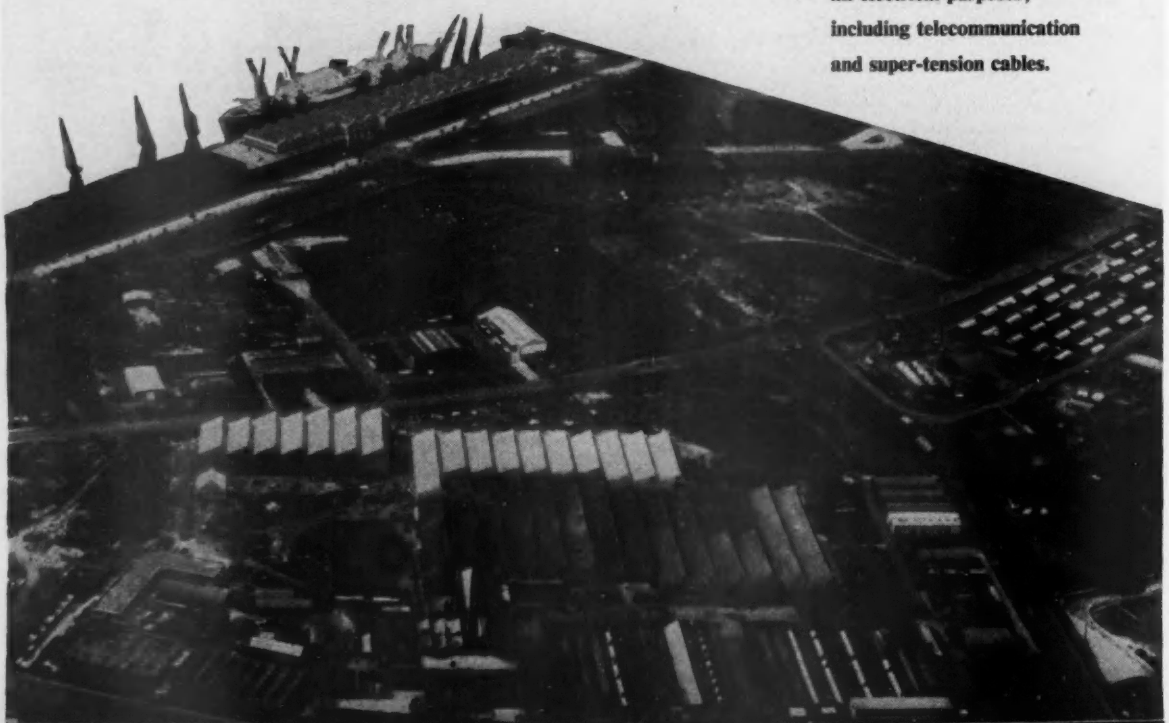

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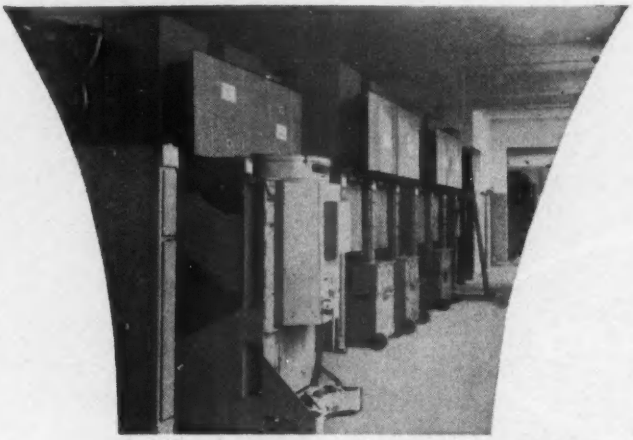

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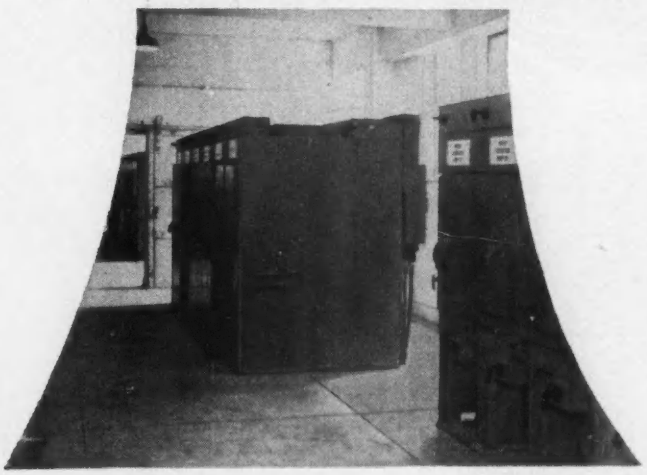

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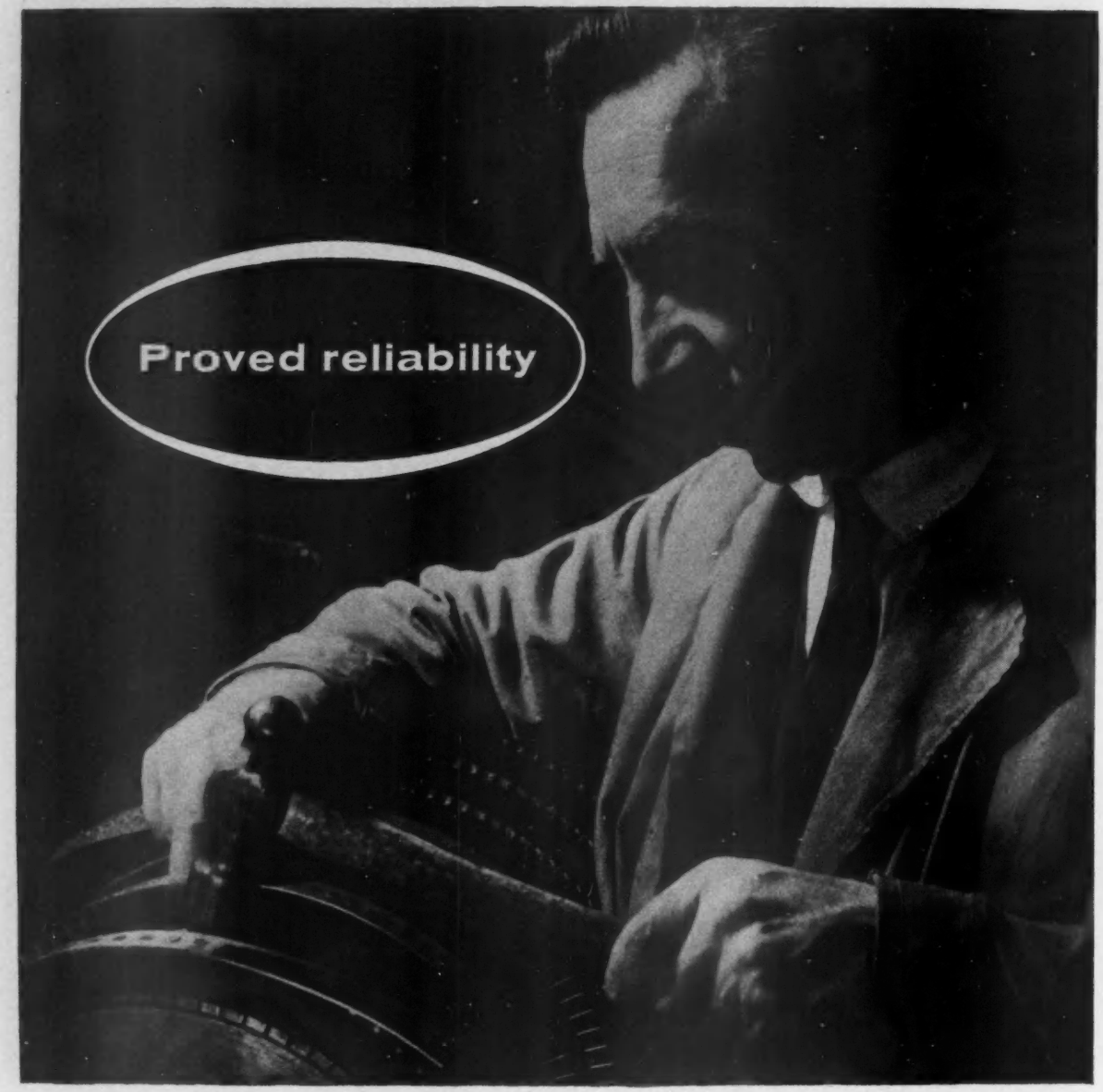

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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2

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Dans ce numéro

Tripleur de fréquence statique 145

La production d'une fréquence triplée à partir d'une alimentation triphasée fondamentale s'effectue simplement avec de l'équipement statique en interconnectant les trois phases de façon à produire une troisième harmonique. Grâce à l'usage de matériaux magnétiques à grains orientés, et à cycle d'hystérésis rectangulaire, grâce aussi à des réacteurs étudiés en vue de saturer à 60°, on améliore la forme d'ondes, on accroît la tension de sortie, et l'efficacité devient sensiblement plus élevée. Un tripleur expérimental a été étudié, qui est capable de donner une sortie de 3 à 4 kW à 150 c/s depuis une alimentation de 50 c/s, et qui comporte un réglage automatique de la tension se fondant sur la réaction depuis des tripleurs de référence. Ce dispositif se prête à l'actionnement des amplificateurs magnétiques à réponse en demi-périodes.

Conventions relatives à l'inductance mutuelle 148

Les discussions qui portent sur les effets d'inductance mutuelle dans l'équipement électrique se compliquent souvent par la confusion quant aux signes adoptés par convention. Accord pratique pour une convention de signe: si les flux produits par deux enroulements s'ajoutent, l'inductance mutuelle entre les enroulements est positive. L'idée générale d'inductance mutuelle pourrait être utilement appliquée à l'étude des transformateurs.

Grosses centrales électriques dans les Etats-Unis ... 151

Un turbo-alternateur à générateur cross-compound de 650 MW sera mis en service dans les Etats-Unis en septembre 1962. La chaudière est chauffée par cyclone, et prévue pour: 2.230 tonnes/heure, à 175 kg/cm² et à 567°C. Les deux alternateurs de 325 MW pour chaque groupe de turbines sont refroidies à l'hydrogène et l'eau. Dans le même article, on examine les expériences relatives au fonctionnement d'un groupe supercritique de 250 MW. Ce groupe fonctionne à 247 kg/cm², et 594°C.

In dieser Nummer

Statischer Frequenzverdreifacher 145

Die Erzeugung einer verdreifachten Frequenz aus einem gewöhnlichen Dreiphasennetz kann auf einfache Weise mit statischen Mitteln erzielt werden, indem man die drei Phasen so miteinander verbindet, dass eine dritte Harmonische entsteht. Bei Verwendung magnetischer Materialien mit ausgerichtetem Eisenkorn und rechteckiger Hysteresisschleife kann man die Eisendrosseln so auslegen, dass sie bei einem Winkel von 60° gesättigt werden, und so die Wellenform verbessern. Die Ausgangsspannung läst sich auf diese Weise erhöhen, und die Leistung erheblich heraufsetzen. Es wurde ein experimenteller Verdreifacher konstruiert, der eine Ausgangsleistung von 3 bis 4 kW bei 150 Hz aus einem 50 Hz Netz liefert. Er arbeitet mit automatischer Spannungsregelung, die durch Rückkopplung aus Bezugsverdreifachern erzielt wird. Die Vorrichtung eignet sich zum Betrieb von magnetischen Verstärkern, die auf Halbwellenwechselstrom ansprechen.

Konventionen betreffend die Gegeninduktivität ... 148

Die Behandlung der in elektrischen Anlagen auftretenden Gegeninduktivität wird sehr oft durch eine gewisse Verwirrung über die das Vorzeichen betreffenden Konventionen erschwert. Als brauchbar im Sinne einer Vorzeichenkonvention kann der Entschluss angesehen werden, dass die Gegeninduktivität zwischen Wicklungen dann als positiv gelten soll, wenn die von den beiden Wicklungen erzeugten magnetischen Flüsse additiv sind. Der Begriff der Gegeninduktivität kann bei der Untersuchung von Transformatoren gewinnbringend angewendet werden.

Grosskraftstationen in den Vereinigten Staaten ... 151

Ein 650 MW Kreuz/Verbundgenerator soll im September 1962 in den USA als Turboalternator in Dienst gestellt werden. Der Kessel arbeitet mit Wirbelfeuerung und seine Nennleistung ist 173 kg/cm², 567°C bei einem Durchsatz von 2230 t/h. Die beiden 325 MW Alternatoren für jeden Turbinensatz sind wasserstoff- und wassergekühlt. Im selben Artikel werden auch Erfahrungen erörtert, die beim Betrieb eines Hochleistungsgenerators von 250 MW gesammelt wurden. Dieser arbeitet mit 247 kg/cm² und 594°C.

Static Generation of Tripled Frequencies 145
by W. L. Marks, M.SC., and L. J. Chant, B.SC., M.I.E.E.

Square Fluorescent Lighting 147

Mutual Inductance in Power Transformer Studies —Part 1 148
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SOME INSIDE INFORMATION ON.....

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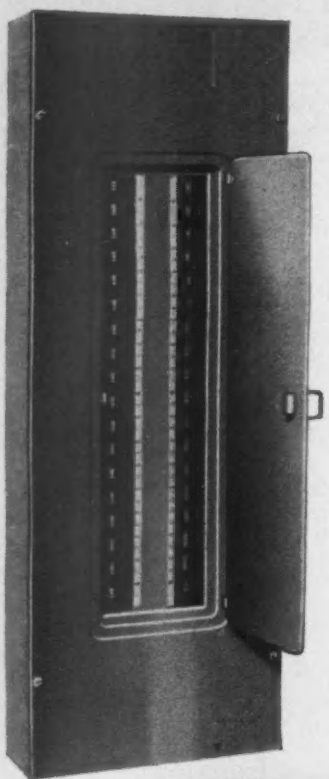

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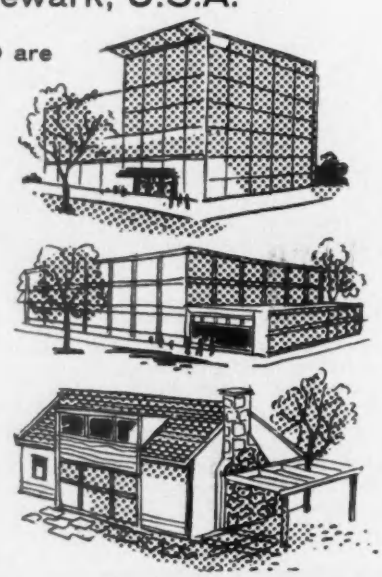

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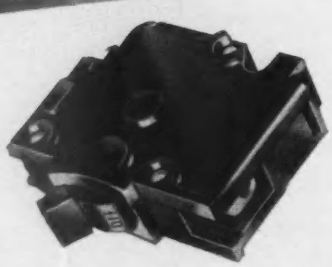

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ELECTRICAL TIMES

ESTABLISHED 1891

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Comment

THE LITTLE BUDGET

Increases in customs and excise duties, including purchase tax, is a far from welcome feature of the Chancellor's emergency proposals. It is, however, preferable from the aspect of the electrical trade to the selective increase in purchase tax and the enforcement of more rigorous h.p. restrictions, such as had become the routine treatment. With some of the spare money that could become an h.p. down payment likely to be mopped up through the widespread price increases, electrical goods will have to compete more strongly with other marginal purchases. They seem reasonably well placed to do so. In another respect, less publicised than the 10% on taxes, the Chancellor seems to have been kinder to electricity than his predecessors in similar difficulties. He plans to permit nationalised industry investment to continue so far as it is necessary to meet prearranged financial targets and provide "essential supplies and services." That should guard the supply industry against ineffective attempts to cut generating plant programmes and all-too-successful curbs on distribution reinforcement. Some marginal programmes will be cut, and research expenditure looks particularly vulnerable in this context. But the heart of the supply industry should continue to beat steadily enough. The section of the electrical scene most severely affected by the new financial restrictions is likely to prove electrical contracting. In the general field of building the Government are taking positive steps to secure a reduction in the amount of work. The contracting industry can take some cut-back with no great loss; shortage of both craftsmen and technicians is already hampering its work to a troubling extent. Whether, as with appliances, restrictive action will introduce more slack than is necessary to correct this situation is difficult to predict. Carried with the contractors will be the accessory manufacturers. For them, too, the golden years may be drawing to a close for a while.

SCOTTISH ADEQUACY

The Building (Scotland) Act, passed two years ago, paved the way for minimum standards of building construction far more wide ranging than those usually laid down in the model bylaws it will displace. Regulations which it is proposed to make under the Act have now been issued in draft form and they hold promise for a sharp improvement in electrical standards in Scotland. If the Regulations pass the public scrutiny to which they will be subjected before becoming law, then all buildings in Scotland will have to have electrical installations at least approaching reasonable standards of adequacy: sixteen 13 A socket-outlets in

a three-bedroom house. Moreover, the installation will have to be served by wiring complying in most particulars to IEE Regulations and in some respects going beyond that level. Even allowing for the inescapable process by which the minima which the Regulations seek to impose will become maxima in the eyes of local authorities and speculative builders responsible for much housing, this is a foundation on which the contracting and supply industries should be able to build to good effect. If the Scottish public can be made to see that these are minimum standards and that the proud householder will want better than that, then the future can look particularly bright. In one respect, the draft regulations hold hope of a dream come true. They offer statutory enforcement for the use of a single design of plug; for "an electricity socket-outlet which will provide safely a current of 13 A by means of a ring-circuit" is a reasonably narrow description of a BS 1363 fitting. That achievement alone would be a notable one.

BLOCK HEATER GAMBLE

For many years now it has been a legal fiction that thermal storage electric block heaters are unsuitable for domestic use. That has been imposed by the definitions used by Customs and Excise authorities in administering purchase tax collection. Electric heaters not suitable for domestic application pay no p.t.; those that can be so used pay a basic rate of 25%. To keep the fiction alive manufacturers have refused to sell block heaters to the general public. Indeed, the simplest kinds of heaters had serious disadvantages for the sharply restricted hours of supply at first imposed in electricity board off-peak tariffs. Now the uneasy truce is being ended by one large manufacturer offering heaters for domestic use. The gamble is that the amount of trade to be got from the domestic market is greater than what may be lost among commercial and industrial customers through the addition of purchase tax. The gamble must stand a good chance of paying off. With the vogue to central heating in houses, on which we have commented recently, the stage is set for selling block storage in the home as a corollary to the floor-warming that cannot readily be installed in existing properties. The requirements for success are attention to the heat demand-time relationship applying in houses, and to the problem of disguising the massiveness of a block heater.

APPLIANCE SAFETY STANDARDS

Progress with initial testing and approval of domestic appliances under the BEAB scheme has been disappointingly meagre in its results. Whatever may be felt about that, however, the situation cannot be blamed on shortcomings in the preparation of suitable standards setting a quality level for endorsement. From the beginning, BEAB approval has been based on British Standards. Initially, an excellent job has been done in reissuing existing standards for domestic equipment in new guise, but largely unaltered, in the BS 3456 series. BSI has been working on this project with a speed which is impressive. There have been many occasions when the Institution has seemed laboured and slow in its attempts to produce new agreed standards. The way BEAB requirements have been met is an eye-opener in this respect. Now the production of an integrated BS 3456 structure to replace the stop-gap reprints is going ahead well. Master standards for general safety requirements for static domestic appliances on the one hand, and motorised appliances on the other, provide the basis. These will be extended through standards for individual appliances to cover the full domestic field. The general requirements, now at an advanced stage of preparation, will provide a valuable guide to manufacturers and to potential importers. They seem likely to impose an effective standard of general quality of construction and performance as well as of safety.

AMERICAN STATION ADVANCES

Power station designers may be forgiven for thinking they have passed the Pearly Gates unawares when they are *paid* 5s a ton for site excavation. Yet this has happened at one USA plant. At the appropriately titled Paradise station of the Tennessee Valley Authority, where the first of two 650 MW sets is scheduled for commissioning next year, the station site first had to be cleared of coal from a near-surface seam which will in the future provide the main supply for the station. The contractors were willing to pay for the privilege. Even with fuel supplies available at the low rates such siting clearly makes possible, US engineers press for efficiency. At Paradise, large sets are the principal feature in this respect. Steam conditions are only the conventionally advanced, sub-critical, 1,053°F, 2,450 lb/sq in. Elsewhere the march into the supercritical region has been pushed forward enthusiastically. At present the difficulties are more apparent than the achievement. Earlier-reported difficulties with temperatures around 1,200°F are now being accompanied by problems traceable to high pressures. At the Avon 8 supercritical installation, for example, an unexpected drop in efficiency has been in part traced to copper deposits formed on the turbine blading. This is a direct result of use of a once-through supercritical cycle. On the more positive side of the American work summarised in our article this week, the use of high-speed boiler feed pumps is notable. Both Paradise and Avon have them. Manufacturers' confidence is sufficient to predict that 3,600 r.p.m. pumps (on the 60 c/s basis) will be obsolescent by 1970. The diversified US supply industry, through manufacturers and operators, is clearly offering plenty for other countries to think about—even in the face of the sometimes hardly believable favourable conditions.

Meteor

This week's quick summary of electrical news faces advertisement page 16

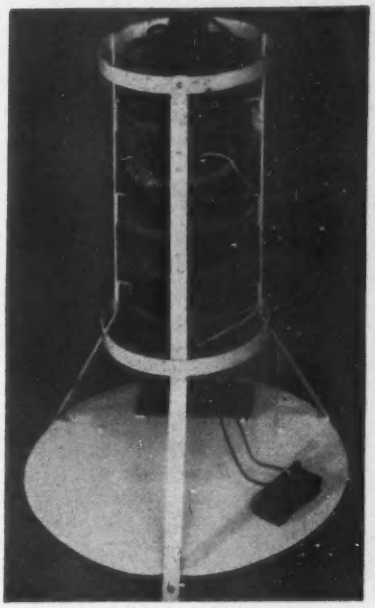
Static generation of tripled frequencies

NEW DESIGN EMBODIES AUTO-REGULATION

by W. L. Marks, M.Sc., and L. J. Chant, B.Sc., A.M.I.E.E.*

A NUMBER of circuit configurations have been developed to generate statically a tripled frequency from a given fundamental supply, whether single- or 3-phase. In most of these employing 3-phase supply, the individual phases are so interconnected as to generate deliberately a third harmonic which represents the tripled frequency. Commercially available static frequency triplers operating on this principle show an efficiency in power conversion at full rated output of 5%.

With a view to improving this figure and obtaining a useful power output for small and medium power control systems, operation of half-cycle response or flux-resetting type magnetic amplifiers, and power supplies for various instrumentation purposes, a new tripler circuit has been devised by the Plant Engineering and Energy Division of the British Iron and Steel Research Association which shows considerable promise. Closer voltage control for such applications as magnetic amplifiers, controllers, etc., is provided by an automatic regulating feature.



General view of the experimental voltage regulated static frequency tripler to give an output of 3-4 kW at 150 c/s (BISRA)

Principle of Operation

The design is based on the use of grain-oriented magnetic materials with very sharp saturation characteristics to divide the individual half cycles of the 3-phase supply into well defined segments. A combination of these segments such as to constitute a tripled frequency is allowed to appear across a load. Fig. 1 shows a typical B—H characteristic of grain-oriented silicon iron in uncut toroidal form. The fundamental equation for induced voltage may be written

$$e = N\,d\varphi/dt$$
$$\int e.dt = \int N\,d\varphi \quad \ldots\ldots (1)$$

in which e=instantaneous value of the induced e.m.f., N=number of turns on the core, φ=flux in the core and t=time.

The flux change $\triangle\varphi$ of Fig. 1 is defined fairly precisely by a rectangular B—H magnetic loop with sharp saturation characteristics. It follows from equation (1) that the volt-time integral $\int e.dt$ required to bring about this flux change $\triangle\varphi$ is as precise as the flux change itself. It is because of this property of requiring a precise volt-time integral in order to effect saturation that rectangular hysterisis loop magnetic material is used in the construction of the tripler in Fig. 2.

Three reactors are shown in the phases of a 3-phase supply. If each reactor is so designed with a flux turn linkage appropriate to a volt-time integral as to saturate at 120°, the currents in the various phases will be as indicated in Fig. 3. While unsaturated, only magnetisation current will flow in the windings of the reactors; when saturated, the current is that demanded by the load. No two reactors are saturated simultaneously and the efficiency of this circuit may well be above 95%. In these conditions, however, the tripler supplies power only during the last third of each half-cycle of the 3-phase supply. Moreover the 150 c/s wave-form leaves much to be desired, though the inductive effects of poorer quality reactors will tend to modify the sharp leading edge of the supply wave-form in most cases.

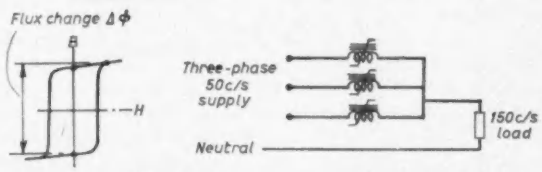


Fig. 1 (left). The B-H loop of grain oriented silicon iron in toroidal form
Fig. 2 (right). Schematic circuit diagram of a basic frequency tripler

A larger output of 150 c/s power results if the flux turn linkage of the reactors is so adjusted that they saturate at 60° instead of at 120°. In this condition, (Fig. 4), there are always two reactors saturated at any instant of time. This causes heavy interphase or circulating currents with a corresponding decrease in power efficiency, a disadvantage, however, which is more than offset by the increased output voltage and the greater power capacity of the tripler.

Voltage Regulation

A simple frequency tripler circuit, comprising three windings connected in star, shows a considerable voltage drop when loaded up to its thermal capacity and some improvement is achieved by a circuit as shown in Fig. 5. The main power tripler is connected to a smaller reference tripler so that any difference between the voltages of the two triplers causes the output voltage of the main tripler to be reduced. At full load the voltages of the two triplers are equal and no control effect occurs.

The correction is conveniently applied to a secondary winding on the main tripler which, as it has induced in it a voltage exactly in proportion to the output voltage, can also serve as the source of voltage to be compared with the reference. Comparison and correction can therefore take place in the one winding by applying the reference voltage directly to its terminals. The number of secondary turns controls the proportion of the output voltage to be compared with the reference.

* Mr Marks is now with the Steelworks Automation Unit of AEI/Davy United Ltd. and Mr Chant is with the ITE Circuit Breaker Co., Philadelphia.

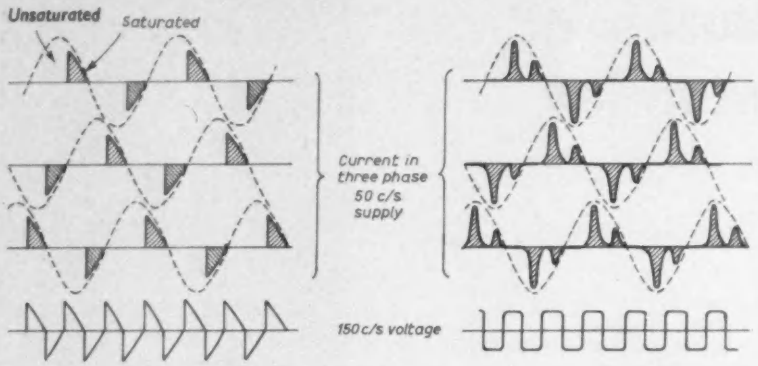


Fig. 3 (left). In the basic tripler power is supplied only in the last third of each cycle and the output wave form is poor

Fig. 4 (right). Adjustment of flux turn linkage to saturate at 60° lowers power efficiency but improves the wave form and increases the output voltage

The theory presented here does not take into account the effects of current flowing in the reference feedback circuit but the regulation improvement given agrees well with the theoretical factors obtained above and it appears that such effects may be ignored.

Feedback Control

Fig. 6 is the equivalent block diagram of a physical system comprising main and reference frequency triplers. The circuit is arranged so that no correction of the output voltage occurs at full load and, at other values of load, the correction is such as to swing the output voltage towards the full load value. Without feedback control, the output voltage at any load is $E_{FL}+\delta E$, where E_{FL} is the full load output voltage of the unregulated tripler and δE is the increment of voltage difference for any other load. With feedback control, the correcting voltage ξ reduces the output voltage to $E_{FL}+\delta E-\xi$. This correcting voltage is the difference between the full load output voltage (E_{FL}) and the fixed reference voltage (E_{ref}).

At full load the correction is zero and $E_{ref}=E_{FL}K$ where K, the feedback factor, is the ratio of feedback voltage (E_{fb}) to the output voltage. Thus, for any load,

$$\xi = K(E_{FL}+\delta E-\xi)-E_{FL}.K$$
$$= \delta E\, K/1+K$$

and the output voltage is $E_{FL}+\delta E\,(1/1+K)$, the regulation, δE, having been improved by the factor $1/1+K$.

The reference tripler is not itself heavily loaded and, if designed to operate from the same supply, will give the same output voltage as the main tripler. Thus, the reference voltage is conveniently the same as the no load voltage of the main tripler and, from the above full load relationship between reference and full load voltages, K is equivalent to both E_{ref}/E_{FL} and the no load voltage/full load voltage. In the experimental tripler, this factor had a value of 1·35 and the regulation improvement factor was, therefore, 1/2·35 or 0·42. The voltage regulation characteristics, both with and without feedback, are shown graphically in Fig. 7.

K could be increased to obtain further improvement of regulation, but this would require a higher reference voltage and a greater number of secondary turns on the main tripler, both of which would add to the size of the apparatus. This was considered unnecessary in the present experimental application.

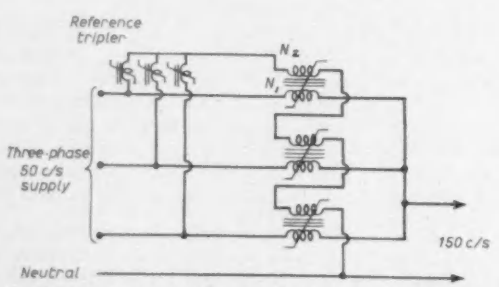


Fig. 5. Circuit diagram of the proposed voltage regulated static tripler

Construction

The tripler built for this investigation was constructed from three grain-oriented silicon-iron toroids of 4 in. internal diameter, 6 in. external diameter, and 2 in. long. When wound, each toroid weighed 43 lb and occupied about 1/5 cu ft in space.

Together with the reference tripler, of slightly smaller dimensions, these were mounted, for convenience, on a flat panel. For works conditions a method of mounting the cores in a stack has been devised which gives both more robust construction and improved cooling.

Design of a Tripler

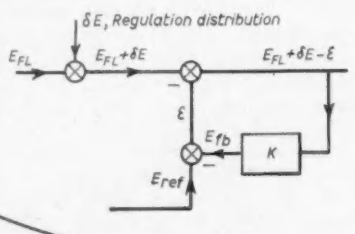
If each core is to saturate 120° after the start of its half cycle, the primary windings on the cores should be designed to absorb 0·75 of the line-to-neutral volt-time integral. In practice this does not allow a sufficient power output and an experimental determination gives 0·7 as a satisfactory figure. Applying the transformer equation, the number of turns, N_1, is obtainable from :

$$N_1 = \frac{0{\cdot}7\times E_{rms}\times 10^8}{4{\cdot}44\times B_m\times A\times f} \text{ in c.g.s. units.}$$

where E_{rms} is the supply phase voltage, r.m.s., B_m is the saturation flux-density of silicon-iron (16 K-gauss), A is the area of cross-section of the silicon-iron toroidal core and f is the supply frequency (50 c/s).

Since the reference tripler is fed from the same supply, identical relations hold in determining the number of turns. The weights of iron and copper required are, however, much less than for the main tripler.

Fig. 6. Equivalent block diagram of a physical system



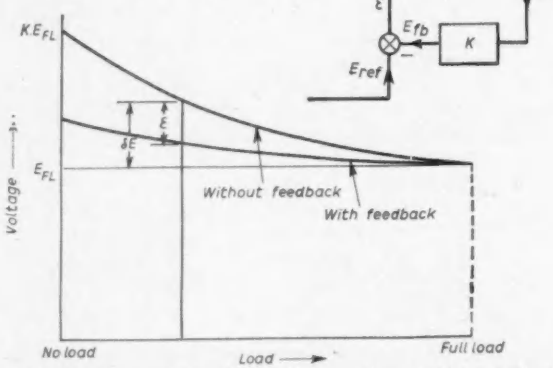


Fig. 7. Voltage regulation characteristics, with and without feedback

In these design conditions the voltage outputs of the two triplers are identical. It is required to decrease the voltage output of the main tripler for light loads to effect regulation. To control the main tripler by coupling to the reference tripler, the comparison voltage of the main tripler must exceed that of the reference tripler except at full load. The feedback ratio, K, of Fig. 6 is therefore made greater than unity. The regulation characteristic of Fig. 8 with no feedback may be used to determine the factor K as the ratio of no load voltage/full load voltage. K was taken as 1·35.

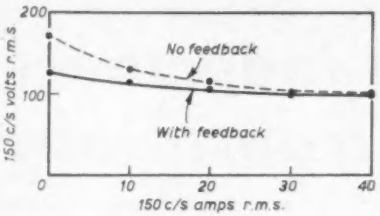


Fig. 8. This regulation characteristic, with no feedback, is used to determine factor K described in the text

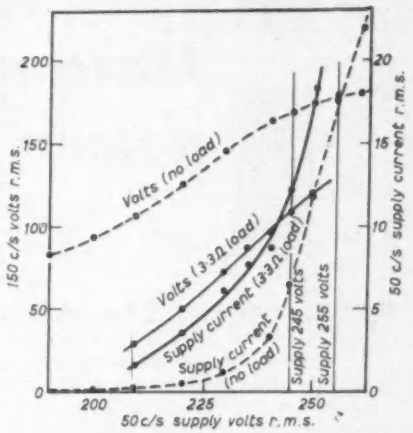


Fig. 9. Family of graphs showing the effect of supply voltage variation on output voltage (150 c/s) and supply current (50 c/s) for loaded and unloaded conditions

In order that the 150 c/s voltage induced in the feedback windings N_2 be equal to the 150 c/s output voltage of the main tripler the number of turns N_2 is equal to $0{\cdot}42N_1$, as determined experimentally. Taking into consideration the effective feedback factor K, the secondary turns become $N_2=0{\cdot}42\ KN_1$.

Performance Characteristics

The interphase circulating current is appreciably independent of the feedback and increases from 8 A to 15 A from no load to full load. With feedback, the voltage regulation is 17% when delivering 3 kW of power, a considerable improvement on 38% without feedback for the same power output. Fig. 9 indicates the effect of 50 c/s supply voltage fluctuations. To keep the 150 c/s voltage variation down, limits for the supply voltage are chosen to correspond to a region of minimum variation of the 150 c/s voltage.

The normal rating is limited by thermal considerations to 3 kW. Observations extending over a period of six hours, long after thermal equilibrium had been attained, showed a temperature rise of 45°C when delivering 3 kW and 70°C when delivering 4 kW.

Conclusions

The tripler described gives a useful 3 kW to 4 kW output. At this it is estimated that the frequency tripler would cost less than a third of an equivalent motor-generator set of, say, 400 c/s apart from having the attractive feature of being static. With a 150 c/s power supply instead of a 50 c/s supply, it is possible to improve the speed of response of small magnetic amplifier control systems by half an order and, in general, it should also be possible to reduce the size of components appreciably. In addition, synchronisation of multiple 150 c/s supplies presents no difficulties.

A frequency of 150 c/s appears to be quite suitable for operating half-cycle response magnetic amplifiers as used in digital computing and logic circuits and work is under way exploring the application of the tripler to precise digital control.

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J. L. Cantwell: "Frequency Tripling Transformers," *Electrical Engineering*, Vol. 55, pp. 784-790, 1936.

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Square Fluorescent Lighting

LAST week these pages reported (page 116) a new form of fluorescent lamp under development in the AEI (Rugby) laboratories. It would seem that a similar design is already in production in America since, according to the AIEE journal, "Electrical Engineering," General Electric has announced the marketing of the new fluorescent panels, each 11⅞ in. square by 1½ in. deep and with either 50 W or 80 W loadings.

As in the British design, the lamp is constructed from two rectangular glass panels fused at the edges. One carries a regular 1¼ in. square "waffle" pattern and the other a 1½ in. dia six-leg labyrinth. The bi-pin terminations are positioned at adjacent corners and are contained entirely within the dimensions of the lamp.

Two types are to be made in each loading; the first emits equal light from either face, while the second incorporates a reflective coating in the labyrinth section to direct most of the light on to the decorative "waffle" section. The 80 W lamp gives an output of 4,800 lumens with an average face brightness of 3,200 ft lamberts. Relative figures for the 50 W lamp are 2,900 lumens and 1,930 ft lamberts. Rated average life is 7,500 hr.

Obviously, the new light source will require new concepts of lighting fittings and it presents a challenge to designers which they will not be slow in accepting. The shape is novel for a light source. Clearly, the new development need not be confined to a square. It opens up an entirely new and fascinating vista of light sources in every shape a designer may conceive.

It was said by the general manager of the GE lamp department, Mr D. D. Scarff, that the development of the new lamp was finalised in 1959. It has taken nearly two years to design and manufacture equipment for mass production and to iron out the inevitable interim problems.

Mutual inductance in power transformer studies

by R. A. Frewer,* B.Sc.(Eng.), A.M.I.E.E.—Part 1

THE conventional approach to the equivalent circuit and vector diagram of the power transformer employs the concept of opposition of primary and secondary ampere-turns. An alternative approach is to consider the transformer as a particular case of mutual inductance, this approach having the advantage that it is adaptable to all types of transformer, not only those working at mains frequency.

Before considering this approach in detail, it is felt advisable to look into some of the more fundamental ideas concerning mutual inductance, in an attempt to avoid some of the confusion which is often associated with this topic, and in particular to establish the sign conventions that will be used later when considering the application of the idea of mutual inductance to the power transformer. These fundamentals form the subject of Part 1 of this article.

Mutual Inductance in a D.C. Circuit

Before tackling more difficult cases, the sign of mutual inductance in the simplest d.c. case will first be considered; namely, that in which the magnetic flux may be considered as being completely contained within the confines of an iron ring. In this way it is hoped to preserve the utmost clarity.

Inductance may be said to exist wherever the field due to current flowing in any elemental conductor links with any other conductor element. If the two elements form part of, or may be considered as, two separate systems, then these systems may be said to contain mutual inductance, and are mutually coupled. Although it is beyond the scope of this article, it may readily be shown that the mutual inductance of one system with respect to the other system is the same as that of the other system with respect to the first considered. The unit of mutual inductance is defined by allowing the current in one system to change, thus inducing an e.m.f. in the other system, such that $E_2=MdI_1/dt$, where subscripts refer to the respective systems, and M is the mutual inductance in Henrys. Now, although mutual inductance is measured for varying quantities, it is essentially a property of the geometric formation of the systems considered, and thus there is no anomaly in considering first the d.c. case.

Considering, then, the case of a single coil of N turns, wound on an iron ring, if it may be assumed that all the flux is contained within the ring it may readily be shown that the self-inductance is given by:

$$L=N^2/S \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (1)$$

where S is the reluctance of the magnetic circuit. Assuming there to be no magnetic leakage, the distribution of the winding need not be considered. The direction of the flux Φ produced by a steady current I is as shown in Fig. 1(a).

Now consider two coils, each of N/2 turns, wound on the same ring, in the same direction, with terminals marked as shown in Fig. 1(b). Note the use of the "dot" convention, in which a dot is placed at the "start" of each winding, where the windings are in the same sense. The total self-inductance between terminals 1 and 4 with terminals 2 and 3 connected together is obviously the same as in the previous case. The self-inductance of each coil taken separately is, however, $N^2/4S$. The discrepancy is, of course, made up by the mutual inductance between the coils such that:

$$L_{14}=L_{12}+L_{34}+2M \quad .. \quad .. \quad .. \quad .. \quad (2)$$

$$\text{i.e. } N^2/S=N^2/4S+N^2/4S+2M \quad .. \quad .. \quad .. \quad (3)$$

and there is no doubt that the mutual inductance is positive. It may be remarked here that it will be assumed within this context that the symbol M replaced a signless, i.e., always positive, numerical value, and the sign under discussion is that prefixing the symbol.

If, now, one coil is moved around the ring as in Fig. 2, conditions are unaltered and M is still positive.

This diagram will be the basis for the determination of the sign of mutual inductance. It is clear that the sign of mutual inductance in this diagram will be reversed if the current in one coil or the other (but not both) is reversed, or, alternatively, if the direction of winding of one coil is reversed. The direction of "spiralling" of each winding is immaterial. A general rule may now be postulated, that if the fluxes produced by two coils are additive, the mutual inductance between them is positive, and if the fluxes oppose, then the mutual inductance is negative. This rule will be applicable, with due care, to the a.c. circuit.

Fig. 2 may now be put in the more general form of Fig. 3, where the currents in each winding are independent, and not all the flux produced by one coil may link with the other. The use of the "dot" convention now implies that if currents flow into the dotted ends of two mutually coupled windings, the mutual inductance is positive. Thus, if one winding is wound in a reversed direction, its finish will be dotted.

The geometry of Fig. 3 corresponds to the physical lay-out of a core-type winding. The rule for determining the sign of mutual inductance, and also the dot convention, may be applied to any configuration; for example, any of those of Fig. 4 in which the current flow for positive mutual inductance is indicated.

Sign Conventions in an A.C. Circuit

Although the sinusoidal case will be referred to exclusively, in the subsequent discussion a more general result may be obtained for all circuit equations by replacing the sinusoidal $j\omega$ by the differential operator.

Before considering mutual inductance in the a.c. circuit, it may be pertinent to examine the relationship existing between a circuit diagram and its vectors on a vector diagram for a simple case. The circuit of Fig. 5 will serve as an example.

Examination of this diagram shows that individual directions have been assigned to the volt drops IR and

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$Ij\omega L$, in accordance with their sense of opposition to the applied e.m.f. In addition, a definite direction has been given to the applied e.m.f., instead of the double-headed and hence meaningless arrowhead often employed. These directions, which may conveniently be termed reference directions, afford a link, in conjunction with the current reference direction, between the circuit equation and vector diagram, so that these three modes of stating the conditions existing in the circuit are mutually compatible, mutually dependent and unambiguous. The appropriate circuit equation may be written:

$$V=IR+Ij\omega L \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (4)$$

Reversal of a reference direction would result in reversal of the corresponding sign in the equation and reversal of the vector on the vector diagram.

This is, of course, elementary, and perhaps pedantic, but these conventions must be fully stated before tackling more thorny topics.

Mutual Inductance in an A.C. Circuit

If the circuit of Fig. 6 is considered, then in the light of the previous arguments there is no doubt that, with the reference directions shown, M is positive.

Assuming the mutual inductor to have resistances and inductances R_1 and L_1 for the primary, and R_2 and L_2 for the secondary, the circuit equations are as follows:

$$V_1=I_1(R_1+j\omega L_1)+I_2j\omega M \quad .. \quad .. \quad .. \quad .. \quad (5)$$

$$V_2=I_2(R_2+j\omega L_2)+I_1j\omega M \quad .. \quad .. \quad .. \quad .. \quad (6)$$

and vectors E_1 and E_2 defined by:

$$E_1=I_2j\omega M \; ; \; E_2=I_1j\omega M \quad .. \quad .. \quad .. \quad (7), (8)$$

where E_1 and E_2 are the e.m.f.'s due to mutual inductance.

If now the reference direction of V_2 is reversed, it is logical to reverse the reference directions of both I_2 and E_1 (although it is not obligatory). If I_2 is reversed, equations (5) and (6) become as follows, thus giving the case for negative M:

$$V_1=I_1(R_1+j\omega L_1)-I_2j\omega M \quad .. \quad .. \quad .. \quad .. \quad (9)$$

$$V_2=I_2(R_2+j\omega L_2)-I_1j\omega M \quad .. \quad .. \quad .. \quad .. \quad (10)$$

Equations (7) and (8) remain unaltered.

The sign prefixing M is thus determined exclusively by the reference directions chosen for currents flowing through the windings, which are in turn usually chosen to be compatible with the reference directions of the applied voltages.

The Air-cored Transformer

The air-cored transformer, in which one side is connected to a source and the other to a load, where there is no electrical connection between primary and secondary, may be regarded as a particular case of mutual inductance where the voltage V_2 is reduced to zero, the load impedance being considered an extra impedance in series with the secondary winding impedance. The reference direction of the secondary current is now chosen purely arbitrarily, and the sign associated with the mutual inductor should be made to agree. In point of fact, lack of knowledge of the sign of mutual inductance is here no handicap to the solution of analytical problems, but is, however, necessary when constructing vector diagrams. This becomes at once apparent when predicting the direction of rotation of a shaded-pole induction motor by consideration of the mutual coupling between the winding and rotating disc. Thus, two distinct vector diagrams may be obtained, depending on the reference directions chosen, one involving the positive sign and the other the negative sign prefixing the mutual inductance symbol.

In the following diagrams, Fig. 7(a) relates to the positive case, and Fig. 7(b) to the negative case, the voltage

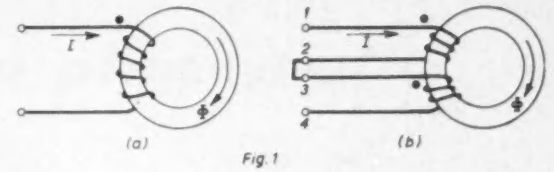


Fig. 1

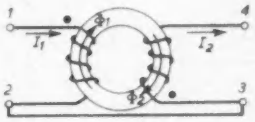
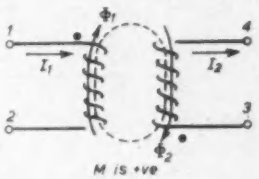


Fig. 2



M is +ve
Fig. 3

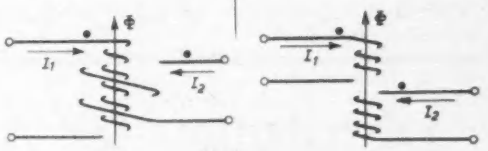


Fig. 4

Figs. 1 to 4. Mutual inductance in d.c. circuits

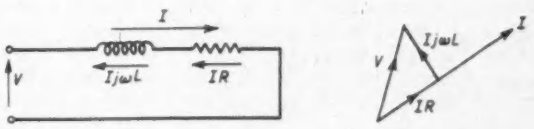


Fig. 5

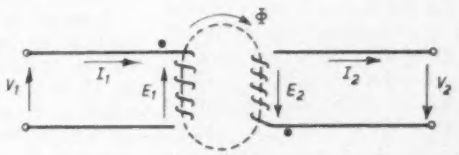


Fig. 6

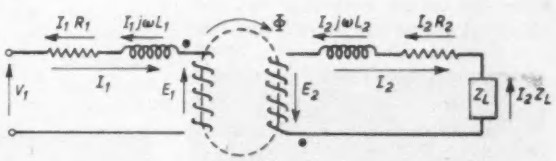


Fig. 7 (a)

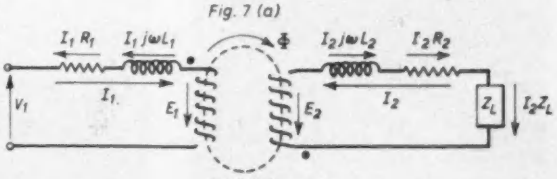


Fig. 7 (b)

Figs. 5 to 7. Mutual inductance in a.c. circuits

V_L representing the voltage developed across the load impedance.

The circuit equations pertaining to the above diagrams are as follows:

For the positive case, Fig. 7(a)

$$V_1=I_1(R_1+j\omega L_1)+I_2j\omega M \quad .. \quad .. \quad .. \quad .. \quad (11)$$

$$O=I_2(R_2+j\omega L_2)+I_1j\omega M+I_2Z_L \quad .. \quad .. \quad (12)$$

For the negative case, Fig 7(b)

$$V_1=I_1(R_1+j\omega L_1)-I_2j\omega M \quad .. \quad .. \quad .. \quad .. \quad (13)$$

$$O=I_2(R_2+j\omega L_2)-I_1j\omega M+I_2Z_L \quad .. \quad .. \quad .. \quad (14)$$

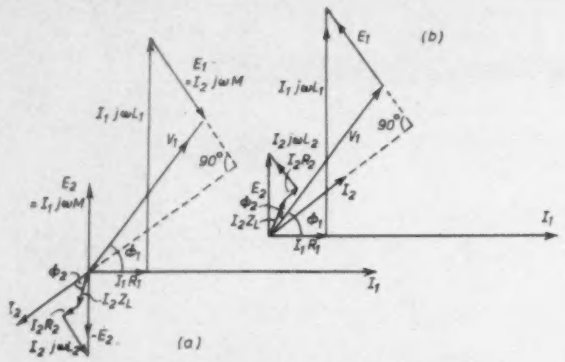


Fig. 8. Vector diagrams for air-cored transformer

In both cases E_1 and E_2 are defined as in equations (7) and (8) and $V_L = I_2 Z_L$.

Vector diagrams may be sketched using the above pairs of equations. Without considering very deeply, it might be expected that some semblance to the conventional vector diagram for the iron-cored transformer would result from one or other of the diagrams of Fig. 8, which are drawn on the conventional unity-turns-ratio basis. However, no such similarity is obvious.

Corresponding vectors in Figs. 8(a) and 8(b) are, of course, of the same magnitude, but in certain cases there are phase reversals to correspond with the reversal of the respective reference directions on Figs 7(a) and 7(b). The primary vectors are the same in both diagrams.

It may be noticed that vectors E_1 and E_2 are neither in phase or in anti-phase, whichever sign of M is taken. The significance of this will become apparent in Part 2 of this article, together with the rather large magnitude of vectors $I_1 j\omega L_1$ and $I_2 j\omega L_2$, as compared to the other vectors, when the above ideas are applied to the iron-cored transformer. *(To be concluded)*

Distribution for Aircraft Maintenance

MAINTENANCE of modern aircraft is expensive in space, and involves the use of a wide range of power tools. This is well shown in the second of the British European Airways maintenance bases at London Airport, which came into full use this year. The base provides two hangars each of five bays. Each hangar is 900 ft long by 142 ft wide by 40 ft high, and has 168 ft clear span arches over the doors. Between the two hangars is a workshop offering 900 ft by 200 ft of clear space for work on engines, propellers and power plants. There are also engine test beds and an auxiliaries overhaul shop.

Services for the building are installed in a 49,200 sq ft basement which lies below the central workshop. The electricity substations are located here, and are equipped with 500 kVA, 11 kV/415 V Johnson and Phillips transformers, two to each substation. J and P interconnecting and pilot cables are used at 11 kV and J and P 415 V switchboards, while British Insulated Callender's Cables have provided cabling for distribution within the hangar bays and workshops.

Local Control

Each of the ten hangar bays has its own panel for individual control of lighting and power. Lighting is provided by 12,400 cold cathode 9 ft tubes, provision being included for operating this lighting in three stages, a third of the lights being switched on at a time.

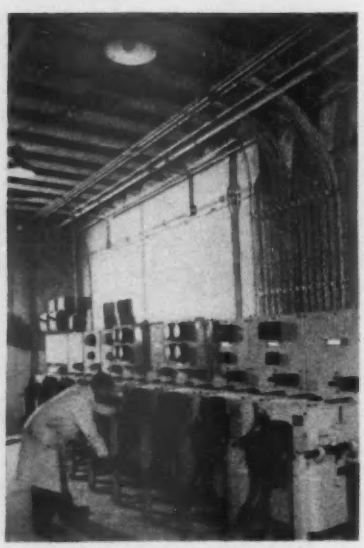
At floor level, each hangar bay is provided with five pits, and these are supplied with a variety of socket-outlets for electric power, ranging from 100 A three-phase to 15 A 24 V.

H.V. Ring-main

One of the substations supplies the above-ground engine test bed. Unlike the others, it is equipped with three 500 kV transformers. This substation is supplied through a tee from a five-panel substation. Otherwise, four-panel J and P h.v. boards are used, connected to form an extension of the ring-main serving the first engineering maintenance base.

All in all, BICC estimate that they supplied 250 miles of various types of cable on this contract. The J and P estimate is 3,000 yd installed by the firm's contract department.

Consulting engineers for the base were Scott Wilson, Kirkpatrick and Partners, with Barlow Leslie and Coombes as the electrical consultants and Rashleigh Phipps and Co. as electrical subcontractors.



East block electrical substation showing BICC cabling and J and P m.v. switchgear

Transformers and (right) h.v. ring-main switchgear in one of the substations

One of the many service pits in the floors of the hangars

U.S. large set plans and experience

PARADISE 650 MW SETS AND AVON 8 SUPERCRITICAL UNIT

LARGE generating plant formed the subject of six papers presented at the recent American Power Conference.* Three papers dealt with experience in the first year of the 250 MW supercritical plant at Avon and a third paper, "TVA'S Paradise Steam Station," by Messrs. R. A. Elliott, W. F. Emmons and H. T. Lofft, of the TVA, outlined planning and design of the station in which the first 650 MW set is scheduled for commissioning in September, 1962. Work began on this station in November, 1959, and after the commissioning of the first set a further unit is planned for July, 1963, with provision for two sets of larger capacity at a later date. The Paradise site on the Green River was selected after a number of other sites had been considered. Its great advantages are the abundant coal resources in the vicinity —coal had to be removed to place the foundations—and a fair supply of water. Transmission costs also showed favourably over the other most suitable site at the Kentucky reservoir.

Large reserves of coal suitable for open-cast mining immediately adjoin the site and, because of the consequent low transportation charges, the cost of 14c per million B.Th.U. is unusually favourable even though the fuel is under 11,000 B.Th.U.; low by US standards. Adequate cooling water for a two-unit plant will be obtained from the nearby river by constructing control dams to give a flow of 1,000 cusec for 95% of the time.

Apart from the size of the generator units, the station will also have a number of other unusual features. Planned eventually as a four-unit station, the electrical control room, service and turbine erection bay will bisect the station with the first two units between these areas and the river. Cyclone-fired boilers will be used with slag tapping facilities operating in conjunction with 600 ft high chimneys. These factors will eliminate the need for both electrostatic and mechanical precipitators. A general purpose digital computer for performance calculations and some degree of automatic operation will be installed with provision for subsequent extension to fully automatic control at a later date. By using flash evaporators, primary water treatment plant will be dispensed with. Auxiliary station supplies are at 6·9 kV and 480 V, intended for larger motors operating at 6·6 kV and smaller units at 440 V.

Coal and Water Supplies

Open-cast coal from the mines will be delivered direct to twin 1,000 ton/hr capacity coal breakers for reduction to a ring size of 3 in. After weighing and cleaning, the coal will be passed to a yard storage pile with a 45-day capacity of 680,000 tons, to a live store with a 2½-day capacity, or direct to coal conditioners and then to the boiler bunkers. The conditioners will reduce coal size to ¼ in. maximum.

Each generating unit will be supplied with cooling water by three 100% duty vertical pumps, having a capacity of 82,300 gal/min, against a head of 28 ft. Each generator will have separate intake and discharge tunnels and the pumps will have separate suction wells. In an emergency two pumps can increase their output by 18%, against a reduced head of 20 ft.

Boiler Plant

The station building, including the two-unit boiler room, turbine hall and basement will have a volume of 15 cu ft/kW. The boilers will be downdraft units with tubular air heaters mounted outside the building between the boiler house and the twin 600 ft high concrete chimneys. The boiler house, on which structural work is well advanced, rises 182 ft above ground level and has a 42 ft deep basement.

Each boiler will be of the once-through type and will have a single, pressurised furnace with two division walls. Their rating will be 4,900 klb/hr at 2,450 lb/sq in., 1,053°F with a reheat flow of 3,480 klb/hr at 474·5 lb/sq in., 1,003°F. The boiler economisers are designed for a feed entry temperature of 533·4°F and return steam from the h.p. turbine enters the reheater at 656·4°F, 500 lb/sq in.

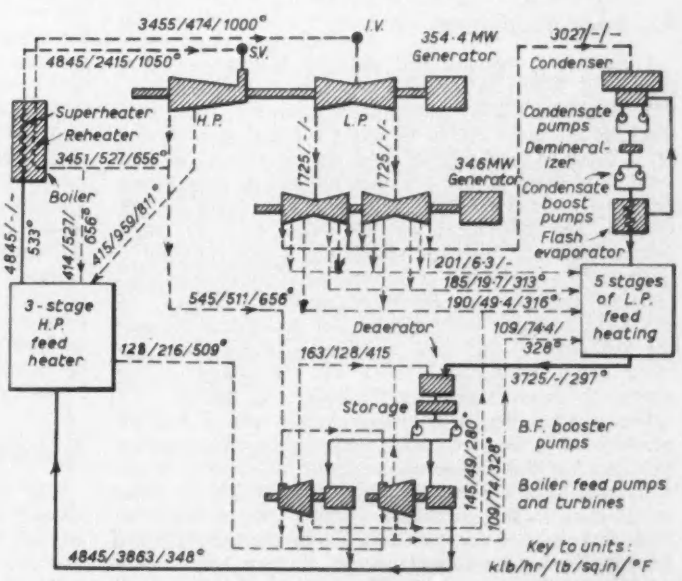


Fig. 1. Paradise steam station will have initially two cross-compound sets, each rated 650 MW. The diagram shows a simplified heat balance for one of the sets. Once-through cyclone boilers are to be installed

* All papers summarised were presented at the 23rd annual meeting of the American Power Conference. The report of the Conference proceedings will be published in the USA in November.

The furnace has a total volume of 340,630 cu ft and a heating surface of 41,067 sq ft, with an additional 252,025 sq ft of superheater surface. The superheater is to be in two sections, a horizontal continuous tube primary section and a pendant platen secondary section at the furnace entrance. The reheater is also of the pendant continuous tube type with a surface area of 82,750 sq ft and the economiser will have a surface of 140,500 sq ft.

Cyclone burners in each furnace will be 10 ft diameter, complete with drag feeders, oil and gas burners and oil ignition torches. Seven are to be installed at the front of the furnace and a further seven at the rear, each with a capacity of 43,700 lb of coal per hour. Estimates suggest that 80% of the ash will be tapped as slag from the bottom of the furnace and the remainder will be sufficiently dispersed as fly ash by the unusually high chimneys to avoid nuisance in the sparsely populated locality where the station is sited.

Water will be supplied to each boiler by 50% duty, five-stage feed pumps driven by 15,700 h.p., 5,500 r.p.m. direct connected, dual pressure, non-condensing extraction turbines designed for variable speed operation. Water will be passed to these boiler feed pumps by three 50% booster pumps. For starting, a single 4,000 gal/min motor-driven pump will be provided, enabling the boiler to be started at full pressure and one-third full load.

The heat cycle provides for extraction at eight pressure stages with the two highest and lowest from the main turbine and the four intermediate stages from the feed-water pump turbines. With 0% make-up and 4% auxiliary power, the estimated plant net heat rate is 8,775 B.Th.U./kWh at an output of 700·3 MW. Each turbine will be a cross-compound machine, designed for initial steam conditions of 2,400 lb/sq in., 1,050°F with reheat to 1,000°F. The 3,600 r.p.m. primary shaft has a single-flow h.p. turbine and a double-flow i.p. turbine with direct connected exciter. The secondary shaft will run at 1,800 r.p.m. and have two double-flow l.p. turbines with 38 in. long blades in the last stages. The unit will have a 300,000 sq ft horizontal single-pass double-flow condenser, designed to condense 3,012 klb/hr of steam at a back pressure of 1·67 in. of mercury.

Electrical Equipment

Each cross-compound unit will include two generators rated 325 MW, 24 kV, 60 c/s, directly connected to 375 MVA, 24/161 kV step-up transformers. The stator windings are to be cooled by water and hydrogen cooling at 32 lb/sq in. and will be used for the stator core and rotor. The main exciter for each set will be gear driven directly from the set shaft with amplidyne regulation of voltage. The generators will be linked to their transformers through buses of aluminium welded channel.

Station auxiliaries are to be supplied through unit transformers, one for each generator, rated 22·5/6·9 kV, 24 MVA. In addition, there will be two station transformers for ash disposal and coal handling services. These are rated 27/45 MVA, 161/6·9/6·9 kV. All auxiliaries are electrically driven except for the boiler feed pumps.

For starting the sets, by-pass valves and a take-off point ahead of the superheater are provided, and a by-pass line ahead of the turbine allows up to full capacity steam and water to be led to a flash tank from which the water is returned to the condenser system. Steam from the flash tank is used for turbine seals, deaeration and feed heating. During start up, estimated at three hours under normal conditions, a water flow of one-third the full load requirement is provided at full pressure by the motor driven starting pump.

Avon 8 Supercritical Unit

Both because of its supercritical operating conditions and also because of its relatively large output of 250 MW, three papers dealing with Avon 8 set are of particular interest. The papers were: "Initial Operation of Avon 8," by N. F. Gill and N. D. Flack, of Cleveland Electric Illuminating Co.; "Supercritical Boiler Operating Experience at Avon 8," by J. I. Argersinger and G. C. Smith, of Combustion Engineering Inc.; and "The Avon 8 Super-pressure Steam Turbine-generator Unit," by C. C. Franck and J. A. Carlson, of Westinghouse Electric.

The Avon unit comprises a once-through supercritical boiler rated 1,715 klb/hr, 3,500 lb/sq in., 1,100°F and a 250 MW tandem-compound turbo-alternator. The turbine is unusual in that ferritic materials have been used for the high temperature components. After just over a year's operation the set was shut down for inspection and maintenance.

During the year and five days that the unit was in operation an availability of 71·2% was attained despite 21 outages. Turbine difficulties accounted for five outages and a further 13 originated in the boiler plant. Nevertheless, the turbine availability was 91·4% and the boiler availability 80%. The authors state that although experiences with the set were not discouraging, they consider the long-term reliability of supercritical sets remains to be proved. Capital cost difference between super- and sub-critical units must be further reduced before the better thermal performance of the supercritical unit can fully justify its use.

Three causes of boiler tube failure were somewhat unusual. In the reheater platen, overheating of tubes occurred during the period of stagnation at a reversion from natural flow to forced circulation. Under full load conditions, water flow through the tubes is under forced circulation, but it was found that in certain parts of the boiler, reverse flow occurred at low loads due to reversion to natural circulation. Bowing of water-wall tubes was caused during initial start-up when steam was formed in them. The steam formation resulted from incorrect operating procedure which allowed the boiler pressure to be below that at the steam saturation temperature. Over-firing also caused tube overheating. This occurred when the firing rate was increased as a result of the time lag between signals for increased fuel flow and those for increased water.

Some troubles were experienced on the turbo-alternator and on auxiliaries. For example, at certain loads the main turbine governor valves tended to oscillate affecting both the pressure and combustion controls. The turbine by-pass system, which operates under severe conditions since it must take steam and water at full operating pressure and discharge at condenser vacuum, was subject to severe vibration during the initial stages of operation. Pressure reducing valves also gave trouble. These are used for reducing the boiler feed pump pressure from 4,500 lb/sq in. to 1,200 lb/sq in. for steam temperature control. Their very short lives in service remains one of the problems to be solved.

Operation of Avon 8

The Avon 8 unit is designed to be shut-down, restarted, phased-in and loaded from a single control room under the control of only one man with one boiler ash man and one "rover." Over 800 quantities, including pressures and temperatures, are monitored to give safety and flexibility. So far two men have been used in the control room with success. The authors consider another year's

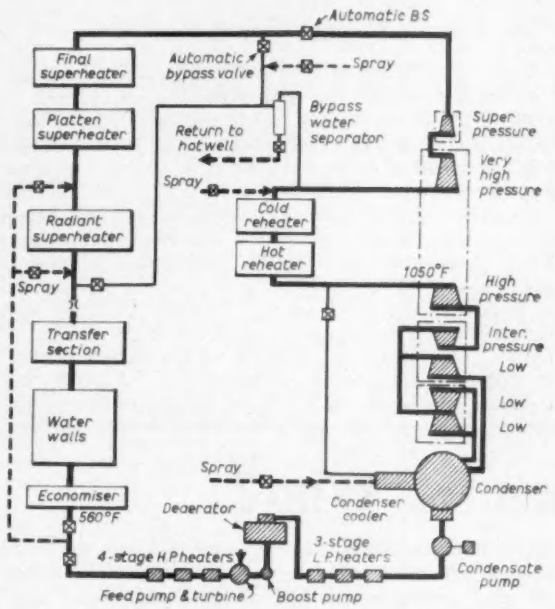


Fig. 2. Simplified diagram of the 250 MW supercritical Avon 8 set showing principal flow paths. The once-through boiler is designed to produce 1,715 klb/hr of steam at 3,500 lb/sq in. 1,100°F

operation would be necessary before the control room could be staffed by only one man.

A very detailed starting schedule was prepared for the set involving hundreds of sequential operations and training the operators to deal with the unusual aspects of supercritical operation proved a considerable problem.

For protecting the unit, 17 automatic methods of tripping are incorporated, 12 for turbine boiler protection and five for generator protection. Four of the boiler protection systems were invoked in the year's operation.

Checks on the performance of the equipment were made during the year, and it was an observed increase in the turbine-generator heat rate of 3·5% that prompted the decision to shut the set down. An examination of the turbine showed major deposits, predominantly of copper oxide, which had formed initially on the last wheel of the super pressure turbine and continued through the very high pressure turbine. Deposits also occurred on the i.p. turbine diaphragms, but these were only a thinly distributed coating of sodium carbonate. A very thin film of silica had also formed on the diaphragms of the double flow l.p. turbines.

From the inspection it was clear that deposition of copper was one of the most important chemical characteristics of the supercritical system prejudicing its efficiency. The presence of nickel and zinc suggested condenser tubes as the source of this impurity. The elimination of this trouble, the authors suggest, is a formidable problem and among the steps to be taken are continuous analysis of the condensate and revision of the cycle pH control to between 8·8 and 9·0 instead of as high as the 9·2 permitted previously.

On the boiler, the by-pass system has been found complicated in operation although otherwise satisfactory except for extreme noisiness. The average yearly heat rate for the unit was 9,629 B.Th.U./kWh, compared with the expected value of 9,127 B.Th.U./kWh. The number of cold starts, and the loss of efficiency when operating the machine at less than full load contributed to the lower heat rate, but a more serious aspect was the progressive decrease, possibly due to deposits in the turbines.

High Speed Feed Pumps

The boiler feed pumps at Avon 8 are also notable for being the first installation in which the full pressure to feed a supercritical set is developed in a single casing. Two of the pumps are turbine driven while the third, intended both as a standby and starting pump, is driven by 4,000 h.p. motors in tandem. The use of tandem motors limits starting current and enables standard 4 kV switchgear to be used. The pumps are driven through hydraulic couplings and step-up gears. Each pump develops 4,515 lb/sq in. pressure in six stages and runs at 5,800 r.p.m. The pumps will deliver 1,026 klb/hr of water and starting takes about 20 sec.

The pumps at Avon 8 are referred to in the "Second progress report on high speed boiler feed pumps" by I. J. Karassik and E. F. Wright, of Worthington Corporation. Since the first installation of high speed boiler feed pumps by this company in 1954, 60 have been put into service and a further 29 are under construction. High speed pumps are defined as those operating above 3,600 r.p.m. and developing more than 1,500 ft head per stage. The report says that although troubles have occurred they have not been specifically due to high speed operation or the higher stage pressures and, in fact, any damage sustained was probably less severe than would have occurred with more conventional pumps. Of the pumps supplied by the company, 73% have electric motor drives, with or without a variable speed coupling between the motor and the step-up gears, and 15% are driven by turbines, while the remaining 12% are directly driven by the main turbo-alterator. The choice of drive, however, is indicative of the power utility policy rather than of their relative merits.

High Frequency Pump Drives

The authors emphasise the merits of a higher frequency source for energising the pump motors to eliminate the need for step-up gearing. They advocate 150 c/s or 300 c/s supplies which would be suitable for speeds up to 9,000 r.p.m. They suggests the use of two electronic converters, one supplying power at a constant frequency of, say, 300 c/s and the other, supplying the pump motors individually at a variable frequency corresponding to the boiler load requirements.

The report analyses the performance and difficulties of seven installations out of the 35 planned or installed. The authors state that although problems have been experienced these have had nothing to do with the concept of high speed operation and conventional pumps may well have fared worse in the same circumstances. Great care must be taken with such factors as cleanliness, warming-up operations and the cooling and injection systems. Life expectancy would seem to be equal to, or better than, conventional pumps. Many problems remain to be solved, for example, prevention of impeller cavitation, causes of hydraulic unbalance and vibration, but the authors confidently predict that by 1970 the 3,600 r.p.m. pump will be obsolete.

Combined Cycle Plants

As an alternative to increasing pressure and temperature to improve efficiency of generating plants, there is the possibility of combining gas turbine and steam plant in a single cycle. In the paper: "Improvements in economics of a 678·5 MW combined cycle plant," Messrs. H. J. Petersen and J. O. Stephens compared, in a design study, capital and energy costs of a combined gas turbine plant

with a conventional coal-fired plant. The plant capital costs were essentially equal, but the combined cycle plant showed a 3·3% efficiency gain over the conventional plant. The heat rate was 8,666 B.Th.U./kWh and to obtain this rate would, the authors state, require either steam conditions of 2,400 lb/sq in., 1,100°F or 3,500 lb/sq in., 1,000°F/1,050°F in conventional plant.

In the combined cycle plant, air and combustion products discharged by the gas turbine set provides the forced draught for the boiler furnace, preheated to 825°F. If necessary, the authors say, forced draught fans can also be included to act as superchargers for the gas turbine set. A simple cycle gas turbine arrangement is used. This comprises two pairs of compressors, each driven by a gas turbine, exhausting through a combustion chamber to the main gas turbine, which is directly coupled to an 88 MVA generator. The gas turbines are designed to burn natural gas at 160 lb/sq in. pressure with a calorific value of 1,000 B.Th.U./cu ft.

The conventional plant considered in the study had steam conditions of 2,400 lb/sq in. 1,000°F with reheat to 1,000°F. The gross output was 705·5 MW with a net output of 678·5 MW, giving a heat rate of 8,962 B.Th.U./kWh. For the combined cycle, using the same steam conditions, the output of the steam unit was 613·3 MW with an additional 78·7 MW added by the gas turbine unit giving a net output the same as for the conventional machines. The 3·3% gain in heat rate for the combined cycle was principally because the output power of the gas turbine is a function of total energy extracted from the gas, represented by a drop in temperature from 1,450°F at turbine inlet, exhausting at 825°F in the furnace firebox, to 300°F at the boiler chimney. Thus 1,150°F was available, compared with 900°F for the conventional plant.

Whose Customer is Who?

WHICH industries are the electrical industry's best customer's, and which their largest suppliers? Such information can be obtained from the tables below which are extracted from input-output tables published last week by the Board of Trade and Central Statistical Office. Their limitation is that they relate to the year 1954 and, while the broad pattern may not be dissimilar, average relationships may not be applicable to more recent years.

The first two columns of each table show the demands made on other industries, while the last two are the values supplied to other industries. The columns one and three show direct requirements of industry on industry. In meeting such requirements, however, each industry will make demands on other industries and in turn those industries on yet a third group. The ultimate analysis of such demands is shown in the net requirements column. The net output is defined here as the industry's contribution to the gross domestic product at factor cost; it represents the value added by the industry to the goods and services used in current production. In the columns giving direct requirements, gross domestic income is taken before providing for depreciation but after providing for stock appreciation; it embraces income from employment and from gross profits and other income.

Electrical engineering (general) requirements per £100 of output, 1954

	Requirements by elect. ind.		Requirements from elect. ind.	
	Direct	Total (net)	Direct	Total (net)
Agriculture, forestry, etc.	—	0·1	—	0·2
Coal mining	0·3	1·7	0·6	0·5
Other mining and quarrying	—	0·2	1·0	0·8
Coke ovens, tar products	0·3	0·2	0·1	0·4
Chemicals and dyes	2·1	1·3	0·5	0·5
Drugs and perfumery	—	—	0·2	0·3
Soap, polishes, etc.	—	—	—	0·2
Mineral oil refining	0·2	0·1	0·1	0·1
Oils and greases	1·0	0·3	0·1	0·1
Paint, plastics, etc.	1·4	0·7	0·3	0·4
Steel, rolling and castings	6·6	3·6	0·6	0·5
Steel-plate and tubes	0·2	0·2	0·4	0·6
Non-ferrous metals	5·4	2·1	0·6	0·5
Motors and cycles	0·3	0·2	3·0	1·8
Aircraft	—	—	1·1	0·8
Railway rolling stock, etc.	0·1	0·2	2·5	1·6
Shipbuilding and marine	0·1	0·1	2·4	1·6
Mechanical engineering	2·9	2·3	2·8	1·6
Electrical engineering (general)	—	52·2	—	52·2
Telecommunications	4·1	2·1	4·5	2·6
Hardware and hollow-ware	1·7	1·0	0·3	0·4
Precision instruments, etc.	0·5	0·4	3·5	2·0
Misc. metal manufactures	1·7	1·1	0·6	0·6
Fibres (cotton and MM)	0·5	0·4	0·2	0·3
Woollens	—	—	0·2	0·2
Hosiery and lace	—	—	0·1	0·3
Other textiles	0·1	0·1	0·1	0·2
Textiles finishing	—	0·1	0·5	0·5
Leather and fur	—	—	0·1	0·2
Clothing	0·1	0·1	—	0·2
Boot and shoe	—	—	0·1	0·2
Cereal foodstuffs	—	—	0·1	0·2
Other manufactured foods	—	—	0·1	0·2
Drink and tobacco	—	—	—	0·1
Timber and furniture	0·6	0·4	0·1	0·2
Paper and board	1·6	1·0	0·3	0·3
Printing and publishing	0·4	0·5	0·1	0·2
Rubber	0·5	0·3	0·2	0·3
China and glassware	1·1	0·7	0·4	0·4
Building materials	0·1	0·2	0·5	0·5
Miscellaneous manufactures	0·9	0·5	0·3	0·4
Building and contracting	0·4	0·5	0·7	0·6
Gas and water	0·5	0·4	0·4	0·5
Electricity	0·8	0·8	1·6	1·1
Services	7·7	10·8	0·2	0·2
Imports	3·5	11·0	—	—
Sales by final buyers	—	0·5	—	—
Taxes on expenditure, less subsidies	0·3	1·9	—	—
Gross domestic income	51·9	—	—	—

Electricity supply requirements per £100 of output, 1954

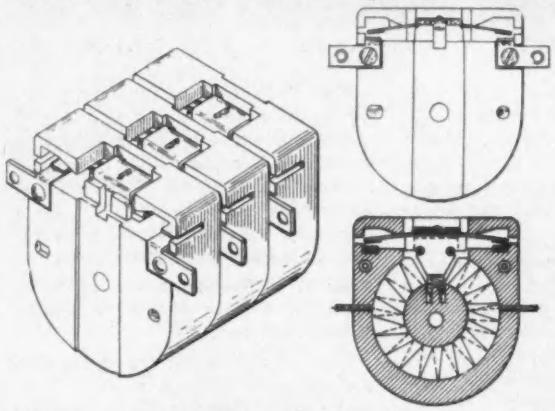
	Requirements by elect. supply		Requirements from elect. supply	
	Direct	Total (net)	Direct	Total (net)
Agriculture, forestry, etc.	—	—	0·4	0·5
Coal mining	22·3	16·8	1·9	1·1
Other mining and quarrying	—	0·1	2·0	1·4
Coke ovens, tar products	0·1	0·1	0·1	0·9
Chemicals and dyes	0·3	0·4	3·0	1·8
Drugs and perfumery	—	—	0·5	0·8
Soap, polishes, etc.	—	—	0·4	0·7
Mineral oil refining	0·4	0·1	0·6	0·4
Oils and greases	0·1	0·1	0·5	0·5
Paint, plastics, etc.	0·2	0·2	0·6	0·9
Steel, rolling and castings	0·2	0·9	1·8	1·3
Steel-plate and tubes	0·3	0·1	1·1	1·3
Non-ferrous metals	0·1	0·3	1·4	0·9
Motors and cycles	0·1	0·2	0·6	0·8
Aircraft	—	—	0·9	0·8
Railway rolling stock, etc.	—	0·1	0·6	0·8
Shipbuilding and marine	—	0·1	0·7	0·8
Mechanical engineering	1·0	1·3	0·8	0·8
Electrical engineering (general)	1·6	1·1	0·8	0·8
Telecommunications	3·6	1·9	0·7	0·7
Hardware and hollow-ware	—	0·1	0·8	0·9
Precision instruments, etc.	—	—	0·6	0·6
Misc. metal manufactures	0·3	0·4	1·2	1·1
Fibres (cotton and MM)	—	0·1	1·0	0·8
Woollens	—	—	0·5	0·4
Hosiery and lace	—	—	0·4	0·6
Other textiles	—	0·1	0·6	0·6
Textiles finishing	—	—	1·1	1·0
Leather and fur	—	—	0·5	0·5
Clothing	0·1	0·1	0·3	0·5
Boot and shoe	—	—	0·4	0·6
Cereal foodstuffs	—	—	0·7	0·6
Other manufactured foods	—	—	0·3	0·6
Drink and tobacco	—	—	0·1	0·2
Timber and furniture	0·2	0·3	0·7	0·6
Paper and board	—	0·2	0·8	0·6
Printing and publishing	0·1	0·4	0·6	0·5
Rubber	0·2	0·3	1·5	1·1
China and glassware	0·7	0·5	2·1	1·4
Building materials	0·7	0·5	2·4	1·6
Miscellaneous manufactures	0·1	0·1	0·8	0·8
Building and contracting	0·2	0·7	0·2	0·6
Gas and water	0·4	0·3	1·2	1·1
Electricity	—	49·3	—	49·3
Services	12·2	12·2	1·1	0·6
Imports	1·6	4·9	—	—
Sales by final buyers	—	0·1	—	—
Taxes on expenditure, less subsidies	4·1	5·7	—	—
Gross domestic income	48·8	—	—	—

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Versatile Contactor

In the design of electrical equipment there is often a demand for a small contactor of relatively light current carrying capacity to control subsidiary circuits, either single or multiple pole. Few of the standard ranges of contactors and relays which are listed in trade catalogues satisfy all of the requirements, more usually failing on the counts of compactness and stability. A new single-pole, double-break contactor described in Specification 873,373



A versatile, neat and compact contactor unit for ganged assembly

and attributed to the Igranic Electric Co., of Bedford, is a singularly neat example of design and would appear to meet most of the conditions called for.

As the drawings show, the contactor is contained in a thin solid-U shaped moulded housing incorporating a laminated toroidal electromagnet gapped at the upper end to accommodate a spring loaded armature which, in turn, supports the spring leaf carrying the two moving contacts. Projections and cavities on the housings, combined with a centrally disposed hole to accommodate a bolt, enable a plurality of contactors to be combined into a single assembly controlling as many circuits simultaneously as may be required. Alternatively, the assembly could comprise a number of single- or multi-pole contactors individually controlled by the control windings.

The fixed contacts are moulded integrally with the main body and have apertures adjacent to permit gases and ionised vapours, incident on rupturing the arc, to escape. The laminated core of the magnet makes it suitable for a.c. energisation and, to prevent armature chatter, a shading ring can be seen surrounding the neck of the armature. Although the device is shown with normally open contacts, it could also be modified to embody normally closed or even changeover contacts.

Reluctance Control

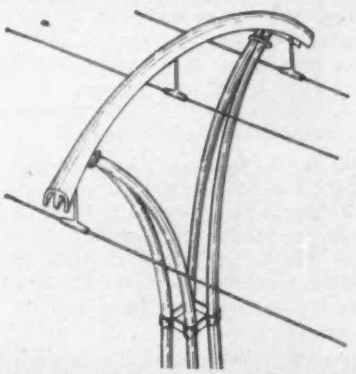
The reluctance of a closed, or almost closed, magnetic circuit may be varied in a number of ways. For example, the introduction of a small, but variable, air path in the circuit will affect the reluctance and, in so doing, vary the inductance of a coil wound on the circuit or the coupling between two such coils on a common magnetic circuit. The principle is often used in electromechanical transducers such as, for example, gramophone pickups.

In specification 869,074 in the name of Philips Electrical Industries of London, another method is described. Here the magnetic circuit, which could be of sintered ferromagnetic material, is interrupted by a cylindrical bore accommodating a close fitting cylinder of sintered ceramic material incorporating soft magnetic particles which have been pre-oriented during manufacture. As a result, the cylinder will have permeabilities in two diametrical directions at right angles to each other which may differ by as much as 20:1. By rotating the cylinder on its axis within the bore, the reluctance of the magnetic circuit can, therefore, be varied cyclically over a large range.

Power Line Supports

Familiarity with conventional overhead power lines invariably conjures up, as part of the picture, long strings of porcelain elements or tall post insulators and bushings; yet, in these days of improved insulating materials with excellent mechanical properties, is it not feasible to construct the supporting arms of insulation and so dispense with the porcelain elements? Such an idea has occurred to two French brothers, Yves-Bernard and Francois-Alain Rondot, of Nantes, and their proposal is outlined in Specification 873,354.

The supporting arm is a moulded section which has been curved to form an arch during fabrication, the section comprising a downward facing channel with a central web to stiffen the arch and, at the same time, provide longer creepage paths. The arch is, in turn,



The cross-arm of this power line support tower is of high grade insulating plastics material enabling suspension insulators to be dispensed with

supported on two pairs of uprights, again of insulating material and preferably of elliptical cross-section, each pair meeting at the upper end to mate with a point, midway between the suspension areas of the conductors, where arch and uprights are joined. At the lower end the four uprights are disposed at the corners of a square and are braced for attachment to a wood, steel or concrete upright or may be continued down to the ground. The power lines are supported from metal stirrups suspended from the arch at the extremities and in the centre.

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Personalities *in the industry*

Mr B. Feltbower

Mr G. C. S. Greenhead

Dr B. L. Goodlet

Mr J. E. Smith

Mr P. Frost

Until recently general manager and chief engineer of the Control Gear Division of the Electro Dynamic Construction Co. Ltd., **Mr B. Feltbower,** B.SC.(ENG.), M.I.E.E., joined the English Electric Co. Ltd. at the beginning of last month and has been appointed chief engineer of the company's Control Gear Division at Kidsgrove. He will be responsible for all the technical administration and new projects of the Division at Kidsgrove. Born in Vienna, Mr Feltbower holds the Engineering Diploma of the Technical University of Vienna, and gained industrial experience in Austria before the last war as a project engineer. He joined Brookhirst Switchgear Ltd. in 1938, where he was responsible for the design and application of control gear, and moved to Electro Dynamic Construction Co. in 1947. Since then, he has been responsible for developing, among other things, automatic standby plants for conventional and nuclear power stations, etc.

Mr S. D. Dorfman has joined the Valor Co. Ltd. as assistant sales manager in its Special Sales Division and will be mainly responsible for domestic electrical heating appliances in Northern England. Until recently he was Northern sales manager with the Harrison group of companies.

District engineer, South Eastern district of the London Electricity Board since July, 1957, **Mr A. J. Spraggons,** A.M.I.E.E., has been appointed to a similar position with the Board's Southern district, but the date on which he will take up his new duties has yet to be agreed (*ESH, pages 82 and 83). Mr Spraggons started his career with the old Westminster Electric Supply Corporation Ltd. and, subsequently, served with the Central London Electricity Ltd. in its St. James and Mayfair and St. Martins districts. In December, 1948, he was appointed district engineer for the St. Martins district with the LEB, and in the following August became section engineer, construction, in the Southern sub-area. He took up his present post in 1957 on the Board's district reorganisation.

Mr G. C. S. Greenhead, F.C.I.S., M.B.I.M., who joined Parkinson Cowan Ltd. two years ago as general manager (administration), has now been appointed to the board of directors. In his new capacity he will be closely concerned with the company's commercial development and general administration. Prior to joining PC he had 24 year's experience in light engineering, with a wide executive experience in the financial, marketing and manufacturing fields.

Managing director of the Brush Electrical Engineering Co. for the past 3½ years, **Dr B. L. Goodlet,** O.B.E., SC.D., M.I.MECH.E., M.I.E.E., is retiring from that position owing to ill health. But he is to continue his association with the company as vice-chairman. His successor as managing director is **Mr J. E. Smith,** M.I.MAR.E., who has held a similar post with the National Gas and Oil Engine Co., another concern in the Hawker Siddeley group. Mr Smith has had considerable experience in both the production and sales of power generation equipment. He was with the Richardsons Westgarth group for 29 years and held a number of managerial posts before his appointment as managing director of one of their major subsidiaries. Dr Goodlet joined Brush in April, 1956, as chief engineer and director. Prior to that he was with the AERE as deputy chief engineer, with responsibility for engineering research and development. He was in charge of the design study of the first nuclear power plant at Calder Hall. Prior to joining AERE in 1950, he was Dean of the Engineering Faculty, University of Cape Town for four years. During the war he was for a time chief scientist at the Underwater Explosion Research Station, Rosyth, but earlier was Professor of Electrical Engineering at Birmingham University and Cape Town University, following several years experience with Metropolitan-Vickers.

Mr F. W. Stokes has been appointed managing director of Powell Duffryn Carbon Products Ltd.

Personal assistant to the manager of the Capacitor Division at GEC Telephone works, Coventry, **Mr P. Frost** has been awarded a travel scholarship from the Department of Electrical Engineering at the Birmingham College of Advanced Technology. He hopes to use the scholarship to study the manufacture of electronic components, management organisation and technical education in various countries in Europe. With GEC since 1955, he is a member of the Committee of the Student and Graduate Section of the IEE South Midland Centre.

Mr J. V. Santry has resigned his directorship of the Superheater Co., and **Mr J. Mayer,** of International Combustion (Holdings), has been appointed a director (the latter concern recently acquired control of Superheater).

The end of last month brought the retirement of **Mr J. Brocklebank,** M.I.E.E., as district manager of the Western district of the London Electricity Board, a position he had held since 1957, and on Monday last he was the recipient of a presentation by the Board's chairman, **Mr D. B. Irving,** to mark the occasion. Born and educated at York, Mr Brocklebank started his career in the industry with the York Corporation Electricity Department, to which he returned in 1922 after a period with the Scarborough

**Denotes revision to the "Electricity Supply Handbook, 1961."*

Electric Supply Co. In 1924 he joined the Yorkshire Electric Power Co., but in the following year he took up an appointment with the Hammersmith Borough Council undertaking, of which he became deputy chief engineer in 1945. On nationalisation of the industry he continued as local manager and senior executive to the BEA for Hammersmith power station and, later in 1948, was appointed operation and maintenance engineer, Western sub-area, of the LEB. He held that position until taking up the post from which he has now retired. His successor is **Mr A. H. Lowman,** A.M.I.E.E., as we have already reported (*ESH, page 79).

Mr C. C. Knowles, M.B.E., and **Mr J. Douglas Hood,** C.B.E., have been appointed to the board of directors of William McGeoch and Co. Ltd. Mr Knowles has served with the company since 1914. He became an assistant departmental manager in 1920, a departmental manager in 1924, and was promoted to works manager in 1947. He is also a director of two companies of the McGeoch group, Verity's (Maxlume) Ltd. and Verity's (Switchgear) Ltd.

Appointed as general manager, Winding Wires Division of British Insulated Callender's Cables Ltd. as from 1 Aug., is **Mr J. Large,** B.COM., who has been winding wires divisional manager at Huyton Quarry since June, 1955. In his new position he is responsible for the administration of the Division and the operation of the Huyton Quarry, Melling and Bessbrook (N. Ireland) factories. The last named was only acquired by BICC in June. The home and export commercial activities of the Winding Wires Division will be operated by Mr Large from Huyton Quarry, near Liverpool, in conformity with policies indicated, respectively, by **Mr C. H. Broughton Pipkin,** executive director (home) and **Mr H. F. Akehurst,** assistant managing director. Mr Large was educated at Prescot Grammar School, and took the B.Com. degree of London University. He joined the former British Insulated Cables in 1943 at their Edinburgh factory. After the formation of BICC in 1945, through the amalgamation of BI and Callender's, he became cost accountant, Accessories Division, at Prescot. The following year he was appointed deputy cost accountant to the new company, and in 1953 was promoted to cost accountant.

London Transport announces that **Mr H. E. Styles,** B.SC., F.R.I.C., F.S.S., F.INST.PET., has been appointed director of research with effect from 31 July, 1961, in succession to **Mr A. T. Wilford,** who retired at the end of July. **Mr A. G. Collings,** B.SC., F.R.I.C., has been promoted to assistant director of research, from the same date. Mr Styles is also chairman of the sub-committee of the National Illumination Committee concerned with lighting for transport, and represents London Transport on the Illumination Industry Standards Committee of the BSI.

Newly elected vice-chairman of the governing body of the Welsh College of Advanced Technology is **Mr J. Vaughan-Harries,** M.I.E.E., district manager at Cardiff to the Brush Electrical Engineering Co. Ltd.

Wilkins and Mitchell Ltd. announce that **Mr E. S. Holland** has been appointed sales manager of "Servis" domestic appliances, Home and Export Divisions. He was formerly "Servis" export manager from 1952 and prior to that, sales manager for Scotland from 1948.

A member of the BSI Electric Cooker Technical Committee, **Mr S. G. Nimrod,** A.M.I.P.E., A.M.B.I.M., has been appointed chairman and managing director of Backer Electric Co. Ltd. in succession to **Mr C. M. Kramer,** who died recently. He has been with the Backer organisation since 1938 and served in the capacities of works superintendent, works manager, technical director and finally deputy managing director. Mr Nimrod has served on several BEAMA committees and, until this year, was vice-chairman of the Cooker Section Technical Committee and member of the Radiant Hotplate Technical Committee. He has studied the commercial and technical development of the heating element industry in Commonwealth, European and Scandinavian countries.

Formerly at the Leeds office of George Ellison Ltd., **Mr E. R. W. Brinkworth,** A.M.I.E.E., has been appointed their Nottingham engineer. He succeeds **Mr Sidney Brown,** A.M.C.T., who retired after 32 years' service. Educated at Birmingham College of Technology, he subsequently joined GEC Ltd., becoming technical sales engineer in the switchgear estimating department in 1947. He joined the head office of George Ellison Ltd. in 1948. Mr Brown joined the company in 1929 after being with British Westinghouse Ltd. and Metropolitan Vickers Ltd. at Leeds. He was for some time member of the branch council of the Derbyshire and Nottinghamshire area Association of Mining Electrical and Mechanical Engineers.

A further stage in the expansion of its Lighting and Heating Group are the recently announced appointments by GEC Ltd. **Mr C. Dykes Brown,** M.I.E.E., F.I.E.S., F.R.S.A., becomes group technical manager. He has been with the company for more than 30 years and will be responsible for the development of major lighting and heating project business. He will also assist in the formulation of policies for product design application, development and marketing. Formerly with Standard Triumph International at Coventry, **Mr G. Galletly** joins the group as marketing manager where he will be responsible for distribution, sales planning and home sales. Before joining Standard Triumph, Mr Galletly was assistant sales director with Massey Ferguson (UK) Ltd., where he planned and managed large scale marketing operations. Other appointments in this group include **Mr R. E. Reuberson,** home sales manager and **Mr C. F. Perkins,** distribution manager.

We are now able to reproduce, below, the portrait of **Mr S. J. Parsons,** B.SC., A.M.I.E.E., whose new appointment as general manager of the Electrical Division of the Expanded Metal Co. Ltd.,

Mr. G. Galletly

Mr. S. G. Nimrod

Mr. S. J. Parsons

Mr. E. S. Holland

Mr. J. Large

and a director of its subsidiary, the Cressall Manufacturing Co., we noted on 20 July. Mr Parsons was previously director and general manager of Mersey Cable Works Ltd.

Mr Arthur E. Foot has been appointed general manager of G. S. Peckham and Co. Ltd. He has been with that concern for nearly seven years, following experience with a firm of electrical contractors.

James A. Jobling and Co. have appointed three new industrial sales representatives—**Mr D. C. A. Lown**, for London postal area, **Mr E. V. Saunders** for North Midlands area, and **Mr J. H. Prime** for the South Western area.

The Minister of Power has reappointed three chairmen of Electricity Consultative Councils—**Ald Commander D. S. E. Thompson**, for South Eastern, **Lady Carew Pole**, O.B.E., for South Western, and **Ald the Rev R. A. Giles**, M.A., for the Midlands.

Lately sales director of Cossor Radar and Electronics Ltd., **Mr K. Newlands** has joined Elliott-Automation Ltd., as director of overseas operations, a new post created as part of the plan to expand the group's export business.

Formerly with Charles Colston Ltd., **Mrs Zena Cawley** joins HMV (Domestic Appliances) Ltd. as chief lady demonstrator. She will train and supervise a team of demonstrators as well as assisting in marketing new products.

OBITUARY

Dr A. E. Grauer who recently delivered a noteworthy paper at the BEPC conference, Eastbourne, died at his Canadian home on 30 July. He was chief executive of the British Columbia Power Corporation and its subsidiary, British Columbia Electric. Aged 55, Dr Grauer was serving his second term as Chancellor of the University of British Columbia from which he graduated. He taught for several years at the University of Toronto where he headed the department of Social Sciences before joining BC Electric in 1939.

Chief engineer of the Special Products Division of Thorn Electrical Industries Ltd., **Mr B. Stevens**, died recently. He joined Smart and Brown (Engineers) Ltd., which later became one of the Thorn Group, in 1939, and became chief engineer at the Spennymoor works. He was later appointed chief engineer in the Special Products Division where he was concerned with development of visual glide path units for airfields.

Materials for Electrical Design

P.T.F.E. WIRE REPAIRS

POLYTETRAFLUORETHYLENE (p.t.f.e.) covered wires will stand up to quite considerable stresses in the ordinary course of events, but the insulation can be damaged by cutting or heavy abrading. In such circumstances, localised damage need not involve the scrapping of the whole component; an effective electrical repair can be made in less than ten minutes with "Teflon" FEP resin film and TFE tape in a simple preheated die.

First, the damaged insulation is removed from the wire for a distance of ¼ in. to ½ in. leaving the undamaged insulation on both sides of the gap uniformly tapered. The film is then wrapped with a 50% overlay, from high on the insulation, over the gap, to a similar point on the other side. Two similar layers of unsintered 3 mil by ¼ in. wide TFE resin tape are then tightly wrapped over the film to the full thickness in the gap and the whole is transferred to the die, preheated to 720°F, and closed with hand pressure for about 5 sec. On removal, flash is trimmed off and the completed repair is ready for service. *Dupont de Nemours, Polychemicals Dept., Bush Hse, W.C.2.*

ELECTRICAL HARDBOARD

A NEW electrical grade of hardboard, "Duranite," is now available which combines good mechanical and abrasion strength with low water absorption and acceptable electrical properties for low and medium voltage applications. It is made in three thicknesses, $\frac{1}{16}$ in., ¼ in. and $\frac{1}{8}$ in., in sheets up to 8 ft by 4 ft. Insulation resistance (ASTM D.257) is given as 70·3 megohms, 31 megohms and 36·7 megohms, respectively, at 500 V d.c. and dielectric strength (ASTM D.149-44) 13 kV, 16 kV and 22·8 kV puncture between 2 in. dia electrodes with radiused edges. Prices range from 9d/sq ft to 1s 3d/sq ft. Of South African manufacture, it is available from the distributors for the UK., *The Wood Fibre Wallboard Co. Ltd., 8 City Rd, E.C.1.*

HIGH TEMPERATURE GREASE

FOR the electrical designer of appliances working at elevated temperatures, one problem is that of satisfactory lubrication. "Rocol" Molytherm grease has been designed for continuous service above 350°F and will withstand 450°F for extended periods and 550°F for short periods. It contains the solid lubricant, Molybdenum disulphide, in a high flash-point oil with a non-soap thickener. *Rocol Ltd., General Buildings, Aldwych, London, W.C.2.*

CELLULOSE INSULATING TAPE

A NEW low-cost insulating tape for the electronic and electrical industries, based on pure transparent cellulose acetate key-coated with an electrical grade adhesive, is now on the market. The tape can withstand a working temperature of up to 130°C without loss of insulating strength and it possesses easy unwind properties, which makes it of particular value in the manufacture of coils incorporating fine gauge wire. *Paynes Jiffytape Ltd., 1-6 Speedy Pl, Cromer St, W.C.1.*

ONE-COAT ACRYLIC ENAMEL

FEW of the so-called one-coat white enamels used on domestic electrical appliances manage to preserve their appearance indefinitely under normal conditions. Usual shortcomings are yellowing, loss of gloss and abrasion, while hot detergent liquids will often completely remove the stoving grades in a very short time. For "Armacryl," a new one-coat acrylic finish by Griffiths, it is claimed that it will retain its colour against prolonged heating, over-stoving or exposure and its hardness, resistance to abrasion and impact is also unaffected by adverse conditions normal to domestic usage. Boiling in a 2% domestic type detergent solution for eight hours only raises a few very fine blisters. Application may be by spraying or dipping with stoving by convection at a minimum of 300°F for 30 min. *Griffiths Bros and Co. (London) Ltd., Armour Works, Well Lane, Wednesfield, Staffs.*

POLYTHENE PRICES CUT

AN announcement of considerable importance to cable makers and users of polythene insulation has just been made by ICI. This is a further cut in prices, the fifth in three years, ranging from 14% to 18% according to grade. The last cut, eight months ago, brought the cost down to about 1s 10d/lb; now it is from 3d to 4d lower. Since 1958, the price, then 3s 3d/lb, has almost been halved.

ICI are the biggest producers of polythene in the UK, with a capacity of over 100,000 tons/annum which is sold under the brand name of "Alkathene." It was, of course, in ICI laboratories that polythene was first discovered. The latest prices are designed to be competitive with any from overseas sources, grade for grade.

Apart from its use as insulation, engineers are considerable users of polythene sheet and film for packaging electric components to protect them from deterioration through dampness while in transit or store. ICI are also planning to link with E. S. and A. Robinson for joint development of packaging grades of polythene and other plastics films. Improved sheet materials may therefore shortly be marketed as a result of the new arrangement. *Imperial Chemical Industries Ltd., Plastics Division, 4 Park St, London W.1.*

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to facilitate tasks; all make instructive reading.

Test Room Error

WITH Indian summers what they are, most VIP's in our city use air conditioners in their rooms continuously. One particularly hot day an influential and important consumer phoned us in the morning to say that his conditioner kept tripping as soon as he put it on. We immediately took steps to remove the unit to our test room for examination and repair but, as soon as we plugged it in to the test board, it worked without trouble.

Incidentally, the conditioner motor was a single-phase capacitor type, with connections to the mains via an ordinary two-pin and earth-type plug.

We advised the consumer that we could find nothing wrong, so he asked us to return it to his bungalow. Full of confidence we took it back and connected up. To our horror and surprise it tripped as soon as we switched it on. Mortified and mystified, we had no alternative than to take it back to the test room and try again. Once more it worked perfectly on the test socket, but this time we were not to be misled.

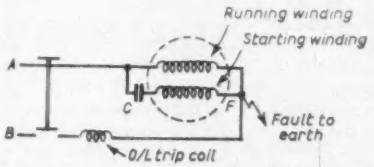
A megger test indicated an earth fault on the motor winding and, on further examination, an insulation breakdown was discovered at the point shown in the diagram. This was repaired and the unit was returned to the consumer, who reported no further trouble.

The cause of our mystification is quite evident. Whereas the live socket at the consumer's premises happened to coincide with pin B of the connecting lead, so applying a dead earth through the trip coil, on our test bench it coincided with pin A, when the resistance of the motor windings prevented the fault from becoming evident. The moral is, when testing, try both pins to the live line in turn.—*H. M. Pai.*

Dry Earth

A CUSTOMER complained that he had received a severe shock while using a portable electric drill in his brick-built, concrete-floored garage, a converted farm building with water laid on some 30 yd from the roadway. It was a very dry period of the year and the concrete floor seemed free from moisture.

The garage was wired in three-core t.r.s. cable, the earth terminating in a good quality earth clip properly secured around the lead water pipe feeding the tap. A three-pin switch socket mounted over the bench provided the feed to the portable electric drill. Continuity and earth tests with a megger indicated that



This earth fault on an air conditioning unit was mysteriously absent when tried in a test room

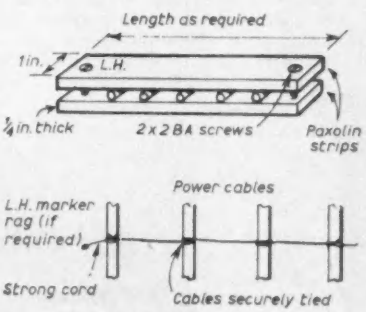
the wiring and connections were O.K., but a further check disclosed an earth fault on the drill armature, the obvious point of leakage. Re-checking the earth points with a test lamp disclosed no light from live-to-earth on the switch socket and, tracing back to the water pipe, no light from live to here either.

We then discovered that no water could be drawn from the tap and, on closer inspection, found that the pipe had been hammered flat just below the tap. Inquiries elicited that this had been done by the previous owner to prevent the children from playing with it. Tracing the pipe from this point, we followed it through the wall, around the back of the building and through a neighbouring garden, where it turned and disappeared below ground. But a little further investigation showed that it had been cut off about 3 in. below ground level.

In wet weather it is possible that the amount of pipe below ground might have given sufficient earth connection to blow the fuse on a fault and protect the consumer from shock; in dry weather, as events showed, it was totally inadequate. A better earthing point was found and the fault was removed from the drill.—*S.R.F.*

Disconnection Aide-memoires

ONE of the problems which arise in maintenance work, when a number of cables or wires have to be disconnected to enable the appliance or piece of equipment to be removed for examination or repair, is to ensure that all of the cables go back into their right terminals when reconnecting. Labelling each cable separately is a tedious job and, even then, there is no guarantee that the labels or identification marks will not be defaced or that they will be reconnected in the right order.



Two useful disconnection "aide-memoires" on routine maintenance work

A simple form of aid to the memory is to make up clamps from two strips of wood with ordinary wood screws at each end and to clamp these round the cables before disconnecting them from their terminal block. The strips can be made up on the site to the required length in a few minutes. Reconnecting then becomes a simple task with no chance of error, even in the most cramped or ill-lit locations.

For heavier cables, the order can be preserved by tying them together in sequence along a piece of cord as shown in the accompanying sketch.—*R.T.C.*

Rodent Earth

AS a supply company's engineer, I was called in, some years ago, to deal with a case where a high rupturing capacity main fuse—I think it was 200 A—on a main incoming switch panel of an engineering works had blown. Isolating all outgoing switches, I replaced the fuse and then closed the switches one by one. The fuse held.

About a week later I was called out again. Once more the fuse held, but this time I carried out a current check. There was nothing to indicate that the fuse was in any way being overloaded by the normal factory loads nor that there had been any untoward incident which could have caused the fuse to blow. I advised them that I would call with a fitter for a fuller examination after the works had closed down the following Saturday. We opened up the back of the panel and, across the busbars between one of the switches and the incoming fuse, we found the body of a large rat, truly charred.

Mr Rat, on his nocturnal rambles, had strayed into prohibited areas presumably in search of some edible insulation. As a consequence, he had provided a very efficient short-circuit and had paid the natural penalty. He was, of course, by no means the first to do so, but what we were never able to understand was how, on this occasion, he had managed to introduce a time delay into his short-circuiting capacity.—*Ion.*

new products and appliances

Japanese low price unit hits tape recorder market

ALTHOUGH it has all the attributes and accessories of a more expensive model, the Japanese "Technicord" tape recorder sells at only 12½ gn. This portable transistorised model is being distributed through wholesale and retail trades and should become popular for its price if nothing else, for comparable models are considerably more expensive. It has 3 in. reels containing 300 ft of double-sided tape, and will record or play for 30 min. No bigger than a book, the tape recorder measures only 2½ in. high by 9 in. wide and 6 in. deep and comes in a moulded plastics case. "Technicord" is supplied with a variety of accessories and a model with foot control is available priced at 15 gn. *Hampden Co. (Sales) Ltd., Glasshouse St, W.1.*

Counter registers equipment life

TO give indication of length of time in operation of electrical equipment, a synchronous clock counter has been introduced giving digital read-out of time expired to the nearest tenth of an hour to a maximum of 99999·9 hr. Powered by a self-starting induction motor, the counter is designed to be connected in parallel with equipment in use. Available for voltages 100 V to 125 V or 200 V to 250 V at 50 c/s or 60 c/s, the device is said to take a current of approximately 10 mA at 250 V. *Measuring Instruments (Pullin) Ltd., Electrin Wks, Winchester St, W.3.*

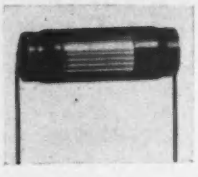
Catering equipment from Simplex

A SO-CALLED "bratt-pan," much used on the Continent for deep or shallow frying, braising or stewing, is one of two new pieces of catering equipment to be introduced under the "Simplex-Creda" trade name. The cast-iron pan, which has capacity to fry 32 lb of potatoes at a time, takes a normal electric load of 12 kW, thermostatically controlled. This can be boosted-up in stages to a maximum of 18 kW if required. The pan can be tilted forward for emptying and cleaning and features two hinged lids which can open sideways to form convenient trays. The unit complete has overall dimensions 52 in. by 28 in. by 36½ in. high and is suitable for three-phase four-wire a.c. supplies.

On a somewhat smaller scale is the "Simplex-Creda" snack-bar fryer. In this instance, the 12 in. dia by 12 in. deep pan is of stainless steel and takes a fixed load of 4·5 kW, once again thermostatically controlled. The heating element is in the form of a plug-in assembly, contributing towards the general ease of cleaning and maintenance, which is a feature of this equipment. *Simplex Electric Co. Ltd., Creda Wks, Blythe Bridge, Stoke-on-Trent, Staffs.*

Cadmium sulphide cell

A NEW photo-electric cell of the cadmium sulphide type, the NSL-33, has a spectral response resembling that of the human eye and has a range of 0·01 ft candles to 1,000 ft candles. It is said to be 1,000 times more sensitive than selenium cells of equivalent area.



The NSL-33 photo-electric cell is 1,000 times more sensitive than selenium types

Tubular in shape, it is 1¼ in. long by 0·345 in. dia and is designed particularly for use in photometers and similar devices where light levels are low. The NSL-33 is to be incorporated in the latest Bell and Howell 8 mm cine cameras. *Hird Brown Ltd., 244 Marsland Rd, Sale.*

Price changes

TWO models in the Ekco heating range are on sale at reduced prices, which took effect on Tuesday. The "Radiant K" combined convector, radiant fire now sells at £11 19s 9d, a reduction of more than 18s, and the "Fandair" turbo fan has been reduced to £10 18s 10d. Both prices include p.t. surcharge.

Grelco Ltd. have made modifications and revisions to prices of their terminal blocks and multi-plug adaptors. These became effective from 17 July.

Final prices for the Morphy-Richards "Radiant Derwent" and portable infra-red fires (ELECTRICAL TIMES, 25 May) are fixed. They are £14 17s 6d for the "Radiant Derwent" and £4 18s 6d for the portable infra-red, including p.t. surcharge.

AEI-Hotpoint have added a 1 kW heater to their range of convector fires. It sells at 7 gn, including p.t. surcharge.

Ekco Heating Ltd., Southend.

Grelco Ltd., Minehead, Som.

Morphy-Richards (Cray) Ltd., 50 Conduit St, W.1.

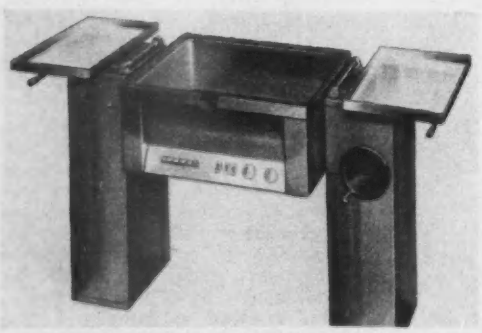
AEI-Hotpoint, Grosvenor Pl, S.W.1.

"Mirror" finish for bowl fire

LATEST addition to the range of Metway bowl fires is a 1 kW model with polished aluminium reflector. Base and guard are of nickel-chromed steel and the reflector is 10½ in. dia. An additional feature is a reflector disc on top of the spiral wound element. Known as the "Mirrorway 1000," this fire costs £1 13s including p.t. surcharge. *Metway Electrical Industries Ltd., Metway Wks, Canning St, Brighton 7.*

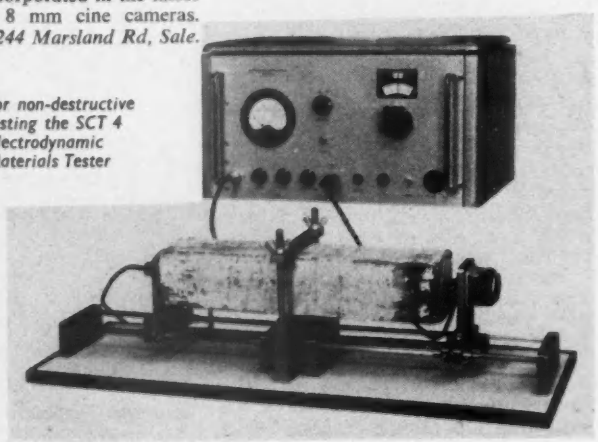
Electrodynamic materials testing

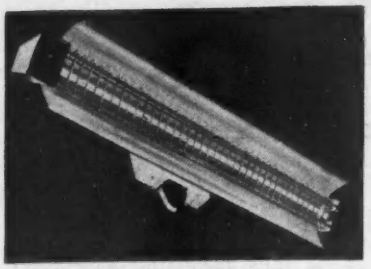
FROM the measurement of resonant frequency of a regularly shaped specimen of material, the elastic constants—Young's modulus, Poisson's ratio and the modulus of rigidity—can be determined without harming the specimen. A new instrument, the SCT 4 Electrodynamic Materials Tester, covering a range from 100 c/s to 10,000 c/s with a calibration accuracy of ±0·1%, enables resonant frequency to be determined rapidly and with little technical skill. *Cawkell Research and Electronics Ltd., Scotts Rd, Southall, Middx.*



One of Simplex-Creda's latest additions to their catering equipment range, a "bratt-pan" for deep or shallow frying

For non-destructive testing the SCT 4 Electrodynamic Materials Tester





For wall mounting, Falk, Stadelmann's "Falcon" 750 W infra-red heater

High-level heater for the home

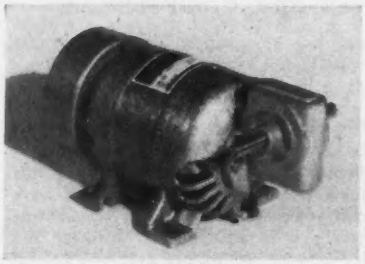
TO meet the increasing popularity of domestic infra-red heaters, Falk, Stadelmann have introduced a high level unit called "Falcon." Designed for wall mounting, this heater carries a 750 W loading and is suitable only for a.c. supplies. Of pleasing appearance, it has a concave reflector and measures 23½ in. wide, 4½ in. high and 4 in. deep. It is finished in ivory and sells at £5 1s 6d, including p.t. surcharge, a comparable price with its contemporaries. The heater is operated by a pull-cord switch equipped with an "on/off" indicator. *Domestic Electrical Appliance Div., Falk, Stadelmann Ltd., 91Farringdon Rd, E.C.1.*

Safe-load indicator

A RECENTLY announced warning device for indicating approach of maximum safe load on cranes and other lifting equipment comprises a load cell, a 12 V transistorised amplifier, and an indicator unit. Two types of the latter unit are available, one having a series of three lamps arranged to light up in appropriate sequence, depending whether the applied load is above, below or at the safe limit. The alternative unit incorporates a meter giving a direct reading of percentage safe load with a red warning lamp to indicate when the limit is exceeded. Both amplifier and indicating units are housed in robust, weatherproof cases, the amplifier incorporating warning lights to indicate internal circuit failure or disconnected battery supply. The load cell, which is of the pressure-sensitive resistance element type, can be inserted at any convenient point of applied stress on the lifting equipment. *Ekco Electronics Ltd., Southend-on-Sea, Essex.*

New fractional h.p. motors

THE first of a new range of fractional h.p. motors announced by Comtex is rated at 1/30 h.p. and is available either as motor alone or with single or double reduction gearbox attached. The units are to be known as Types GL8, GL9 and GL10, respectively, and are manufactured to Class E, BS 2757 standards. The motors will be made either as commutator, capacitor or plain induction, as required, for use on a.c. supplies 50 c/s, 100 V to 110 V, 200 V to 220 V, and 230 V to 250 V single-phase and 400 V to 440 V three-phase. Terminals provide for running in either direction and the capacitor, where fitted, can be incorporated at the end of the unit or mounted separately. *Comtex Ltd., 566 Cable St, London, E.1.*



The new Comtex 1/30 h.p. Type GL10 motor

General-purpose electronic timer

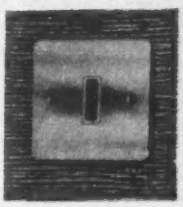
COVERING a wide range of industrial applications, a recently introduced electronic timer is said to be inexpensive and to give a high degree of accuracy. In addition to main components, comprising mains input transformer, thyratron, timing capacitor and resistor, the unit incorporates two Londex relays permitting a variety of switching sequences. Five standard timing ranges are available, each having a wide range of adjustment. These cover from 0·25-7·5 sec up to 4-120 sec. Separate terminals connect the external load switch which is a changeover type, normally open or closed, and capable of handling 3 A at 250 V a.c. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

Disposer with reverse gear

THE flick of a switch on Thompson-Tappan's waste-disposal unit clears any obstruction by setting the grinding motion in reverse. This is claimed to be one of the advantages of the £49 4s appliance, which is mounted beneath the sink. Waste is reduced in size by a shredding vane and hardened tool steel cutter and a splash guard covers the mouth, keeping water and food particles in the disposer. Known as the Super T24, this unit weighs 27 lb, and is 8 in. wide by a little more than 14 in. high. It is finished in white lacquer and has a capacity of 2 qt. The disposer is driven by a ½ h.p. 1,725 r.p.m. capacitor start motor. *John Thompson Instrument Co. Ltd., Ettingshall, Wolverhampton.*

New household switch

Designed to blend with the modern colour are the latest "Wal-rok" switch assemblies. Finishes are now available with pastel silver plates, white switch trims and black switch rockers. Walsall Conduits Ltd., Excelsior Wks, West Bromwich



Ultrasonic detector system

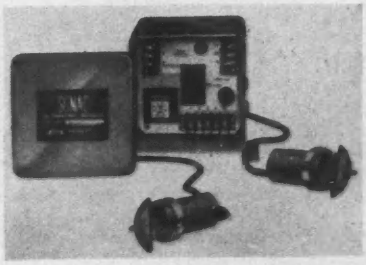
THE use of 38 kc/s sound waves beamed between transmitter and sensor is the basis of a new detector system, "Sonac," which has now been put into production by Westool Ltd. The device, originally developed by the Delavan Mfg. Co., of Iowa, comprises three major units: a control unit, incorporating transistorised amplifier, relay and power pack, and two matched, hermetically sealed magnetostrictive sensors.

The first of these acts as a transmitter, beaming its output across the interception path to the second which acts as a receiver and injects into the amplifier a signal of strength only less than that of the output signal by the transmission losses in the gap. The received signal is amplified to slightly above the strength of the transmitted signal and fed back to the transmitter, so causing the system to oscillate or "howl" at a frequency of about 38 kc/s. Any object interposed between the two sensors increases the loss and oscillation ceases. The reduction in the received signal strength operates the relay to open or close a secondary circuit controlling an indicator, recorder, alarm or other required device.

In an alternative arrangement, both transmitter and sensor are located on the same side, the beam being transmitted at an angle on to the objects being detected so that the reflected beam falls on the receiver. The beam width can be adjusted to cover several feet or to focus down to as small as 0·030 in. dia and it can be reflected zig-zag fashion between two surfaces, such as the sides of a door opening, to give complete coverage of an area, or piped, through a tube or metal bar, around corners.

Normally, variations in the density or temperature of the air in the interception path are automatically adjusted by the amplifier as a slight swing in the signal frequency which, being above the range of the human ear, is inaudible. However, for some applications a significant change in temperature or density can be detected and used to operate the relay, a typical example being the detection of hot billets, emerging from a rolling mill, by their surface temperature.

The device is said to be robust, relatively maintenance-free and its life is indefinite. *Westool Ltd., 2 Ashley Pl, London, S.W.1.*



The "Sonac" detector uses 38 kc/s sound waves

News of the Week

Minimum Wiring for Scotland

Draft regulations say 16 sockets in three-bedroom house

MINIMUM standards for provision of socket-outlets, lighting and heating in houses in Scotland are proposed in the Draft Building Standards (Scotland) Regulations, published by the Secretary of State for Scotland last week. The Secretary is inviting comments on the draft up to the end of November. The hope is that the Regulations may become law by mid-1962.

The Regulations are made under the Building (Scotland) Act, which provides that local authorities shall permit construction of buildings to proceed only, in general, where the requirements of the Building Standards are met. They have been drawn up by an advisory committee who say that they have been designed to combine precision with flexibility of application.

Table 1: Number of socket-outlets.

Position	Number	Position	Number
Living room	3*	Kitchen	3†
Other apartments	2*	Hall	1
		Landing	1

** A gas point may be substituted for one of the electricity points. † Two gas points may replace electricity points.*

Table 1, above, shows the minimum requirements for provision of socket-outlets or, alternatively, gas points. These recommendations are based on current usage and the work of the Building Research Station, which has suggested that "on average" a minimum of 15 socket-outlets be provided for a four or five apartment house. The socket-outlets have to be of 13 A fused-plug type. The Regulations also call for electricity to be used for artificial lighting "unless it is not reasonably practicable to obtain a supply of electricity," and that there shall be a lighting point in every room of 20 sq ft or more area, and in every bathroom, w.c., entrance vestibule, hall, passage and stairway terminal landing.

Heating has to be provided in the living room of each house (and if there is no public electricity supply in at least one other room) in alternative defined forms, one of which is "an electric or gas heating appliance, affixed to the house as a fixture." The heat output has to be at least 6,000 B.Th.U./hr (a 2 kW fire satisfies this) and if an electric fire is used it has to be permanently connected to the electrical installation.

Safety of the electrical installation is dealt with at length. Size and installation of conductors and apparatus are covered, application or fuses and circuit-breakers, earthing and isolation, installation and local control, and precautions against special conditions, such as flammable surroundings or corrosive conditions. Compliance with the appropriate sections of the IEE Wiring Regulations is in general deemed to be compliance with the Building Regulations; a schedule to the draft lists the sections concerned.

Requirements extra to those in the IEE code cover lighting in bathrooms and the provision of wiring diagrams. Under the proposed regulations, it will be necessary to place a schematic diagram of the electrical installation "in permanent form" next to the main switch in each building.

Many aspects of buildings other than those mentioned are dealt with in the Regulations, which are intended to take the place of model by-laws. For example, the provision of laundry facilities is discussed, with a provision that a washing machine of at least 6 lb capacity is acceptable if built-in; so is a built-in refrigerator as full or partial replacement for a larder.

Representations about the Regulations should be made to the Secretary, Department of Health for Scotland, by 1 Dec. next. If necessary, a public inquiry may be held.

Fan Heater Patent Action

AN action for alleged infringement of patent in respect of the "Magicair Supreme" fan heater unit has been started by Firth Cleveland Ltd. against the vendors, Magicook Appliances Ltd. The patent is No. 757,543, and Firth Cleveland claim to hold an exclusive licence from the patentee, Dr Bruno Eck, under which their subsidiary, Solartron Electronic Group Ltd., make and market a fan unit.

Brown-Boveri Licence Terminated

RICHARDSONS, Westgarth have relinquished their licence to manufacture Brown-Boveri steam and gas turbines, turbo-alternators, blowers and compressors. Effective from 1 April last, this move coincides with the pooling of resources for conventional power projects by GEC and Richardsons, Westgarth. Brown-Boveri thermal equipment is now being offered in the UK solely through their London subsidiary, British Brown-Boveri Ltd., and orders will be fulfilled by the Swiss factory.

PHILIPS' NEW SERVICING PLAN

PHILIPS Electrical Industries Ltd. have formed a new subsidiary, Amalgamated Electric Services Ltd., of Waddon Factory Estate, Croydon, to take over all the service activities at present carried on at Waddon by the Central Service Departments of Cossor Radio and TV Ltd., Philips Electrical and Stella Radio and TV. In addition, it is officially appointed service agents for Peto Scott Electrical Instruments Ltd., and Ajax Domestic Appliances Ltd. (Ada (Halifax) Ltd.).

As from September, the new concern will deal with all orders for spares and requests for technical information previously handled by the above concern.

By this move Philips aim to streamline technical and administrative procedure, while ensuring efficiency and reducing indirect costs as much as possible.

Extension for Sofono Electrics

ANTICIPATING a big increase in demand for their electric fires, the Falkirk factory of the Sofono Electrical Division of Federated Foundries is being extended. A new chromium plating plant has been installed, together with new assembly lines and other plant, all of which will be in full production by the end of the summer.

E.R.A. Start on Capacitors and Floor-heating

NEW work on capacitors and on floor-heating has been started by the Electrical Research Association. The July issue of *Co-operative Electrical Research*, the Association's house journal, notes that work is in hand to determine mechanisms of deterioration and failure of chlordiphenyl-paper dielectrics at power frequency. Two grades of impregnants are being compared. The work on floor-heating is a laboratory investigation of a floor-heating system of high thermal capacity, the output of which is largely controlled by forced convection. The working principle involves increasing the bulk of the floor panel with a high degree of thermal insulation and providing air ducts within the floor. During the work attention will be given to relation of duct size to optimum air velocity and performance of various combinations of radiant and convective output.

N.F.E.A. IN COURT

BECAUSE the NFEA head office mistakenly sent out a schedule of charges to an inquirer, Mr L. C. Penwill, the director, stood in danger of being committed to prison for contempt of court. The circumstances were explained in the Restrictive Practices Court last week, when it was held that there was only a technical breach of an undertaking the Association had given to abandon recommended prices.

The application for Mr Penwill's committal was made by the Registrar of Restrictive Trade Agreements. The letter complained of was received by the Borough Engineer of Leyton on 13 June, one day after the Association had given an undertaking not to enforce or give effect to existing price-fixing recommendations. The inquiry from the Borough Engineer had been received by the NFEA on 9 June. The answer included a schedule of charges that had applied from 1 Jan., 1961. It had been sent, the Court found, in ignorance of the undertaking and contrary to instructions given by Mr Penwill, who was absent from the office at the time in question.

The Court refused a request by the Registrar that the undertaking to abandon the price-fixing agreement should be replaced by an injunction requiring this to be done. However, in the course of the judgment it was stated that, from the way the Association organised its business, the Registrar had strong suspicions that the Association was deliberately trying to evade the order of the Court. The January, 1961, schedule of prices had never been registered, although other schedules had.

Mr Justice Diplock, who delivered the Court's judgment, remarked that persons trying to get round the provisions of the Restrictive Practices Act had to understand that they were playing with fire and that if they were unsuccessful the results could be very serious.

I.o.M. TARIFFS UP

AN increase in tariffs, to operate from 31 Aug. next, is announced by the Isle of Man Electricity Board. In the domestic and commercial tariffs, the follow-on or secondary rate rises from 1¼d/unit to 1½d/unit. In the commercial block tariff the final rate becomes 1½d instead of 1¼d, and all unit charges in the industrial power tariff go up by ¼d/unit.

More Electronics Parts from Japan?

GOVERNMENT policy on imports of radio apparatus from Japan is under consideration by the Board of Trade and the Ministry of Aviation. In a written Parliamentary answer, Mr R. Maudling, President of the BoT, acknowledged that some sections of the radio industry would like more freedom than at present to import Japanese components for incorporation in radio sets manufactured in the UK. This preference was to be borne in mind when considering policy for the future.

G.E.C. Shift 'Fridge Production to Yorks

AS the next step in their rationalisation programme, GEC are to transfer the manufacture of domestic refrigerators to their main appliance factory at Swinton, Yorks. At present small models are made at Park Royal and large at Wembley. The changeover is expected to be completed by early 1962.

Hawker Siddeley Rationalise Diesel Activities

HITHERTO operated by separate subsidiaries, Hawker Siddeley's two heavy diesel factories are to be integrated into one organisation. The subsidiaries concerned are Mirrlees Bickerton and Day Ltd. and The National Gas and Oil Engine Co. Ltd., both in the Manchester area. The name of the new organisation has not yet been specified.

Announcing the move last week, Sir Roy Dobson said integration of production and research would help to expand exports. Annual export orders are running at over £8 million.

B.E.A.M.A. CREATE ELECTRONICS BOARD

RECOGNITION of electronics interest is growing within BEAMA as well as the IEE. The BEAMA Council have now established an Electronics Board to represent member companies directly concerned with electronics engineering. The new board will act for BEAMA on matters of broad policy in this field and handle high level liaison with Government departments and other associations.

Mr Leon Bagrit, deputy chairman and managing director of Elliott-Automation Ltd., has been appointed first chairman of the Electronics Board, with Mr O. W. Humphreys, a GEC director, vice-chairman. Other members of the initial board are Messrs E. B. Banks (EE), W. S. Steel (AEI), S. de Ferranti, C. Metcalfe (EMI), and W. Gregson (Ferranti Ltd.), who is at present chairman of the BEAMA Industrial Electronics Equipment Section.

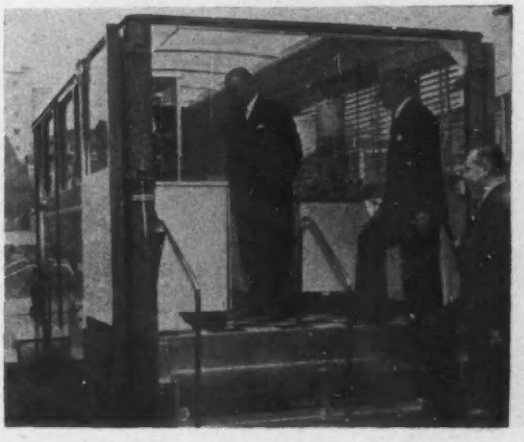
BEAMA point out that they do not intend to assume on behalf of their members responsibility for other sectors of electronic engineering, such as telecommunications and components, which are already dealt with by existing bodies.

Clean Air Progress

SMOKE controlled areas in the Clean Air Act now affect over 623,000 premises in the "black" areas of England and Wales. A further 128,000 premises in these areas are covered by orders submitted for confirmation, according to the Ministry of Housing and Local Government.

MOBILE SHOWROOM FOR LONDON

LONDON Electricity Board now has its own mobile showroom. Within the Board's area there are sufficient exhibitions, horticultural shows and new housing sites to justify this sales aid, one more often associated with rural communities. The mobile showroom is provided for mains supply through a 50 yd three-core flexible cable terminating in a six-way D and S miniature c.b. unit. The equipment for demonstration includes two makes of water heaters as well as a u.d.b. heater. Two cooker control units are arranged for connection through 30 A Reyrolle plugs to the cookers on display, and single- and two-gang switched sockets provide for demonstration of other appliances. The general lighting is by miniature fluorescent fittings in two continuous rows, and fed by transistorised inverters.



LEB chairman Mr D. B. Irving inspects new mobile showroom with Mr W. G. Nottage, Asst. C.C.O., and Central District manager Mr R. G. Tuffnell

OFFICIAL PUBLICATIONS

British Welding Research Association Report for 1960-61. (See page 166.)

Regional Development Plan for Courses for the Diploma in Technology. London and Home Counties RAC.

Input-Output Tables for the UK, 1954. HMSO, 7s 6d. (See page 154.)

Draft Building Standards (Scotland) Regulations, 1961. HMSO, 5s. (See page 162.)

Memorandum on Draft Building Standards (Scotland) Regulations, 1961. HMSO, 4s 6d. (See page 162.)

Consumer Protection Act, 1961. HMSO, 9d. (See page 167.)

Specification for Electroplated Coatings on Threaded Components. BSI, 7s 6d.

ELECTRICITY PROMINENT AT B.A.

TWO sessions at this year's British Association meeting will concentrate on topics of electrical interest. One will be concerned with unconventional methods of electricity generation, the other with the relation of power supplies and water resources. The meeting is being held from 30 August to 6 September in Norwich. President is Sir Wilfred Le Gros Clark.

The session of the Physics section devoted to unconventional methods of energy conversion will include a paper by Mr F. H. S. Brown, CEGB, on practical considerations, and supporting papers on magnetohydrodynamics, thermionic generation and thermoelectric generation.

The session on power supply and water resources is organised jointly between the engineering, zoological and geography sections. After an introduction by Mr O. S. Woods (assistant director, Midland Region, CEGB) there are to be papers on a variety of topics that include biological effects of hot water discharge from power stations and heat disposal from open water surfaces as well as a description of the recreation uses of a hydro-electric reservoir in the USA.

Amongst other papers to be presented to the conference are a study of problems of the fuel cell, a description of mechanisation of the postal services and a paper in the Engineering section on the stator-fed variable speed a.c. motor. President of the Engineering section is Sir Gordon Radley, who will speak on world-wide communications.

The Economics section has several papers of broad interest to the electrical trade, including one by Mr N. A. H. Stacey (GEC) on the impact of distributed developments on the British economy.

M.A.N.W.E.B. INSPECTION SCHEME

CONSUMERS in the Merseyside and North Wales area will have an electricity board installation inspection service available shortly. The MANWEB Electricity Consultative Council was told this at their meeting yesterday. Consumers using the service will receive a written report on the state of their installation.

Charges for the inspection will vary according to the size of the installation. For most domestic premises and farm houses (up to ten assessable rooms) a charge of £1 10s will be made. 2s 6d will be charged for each extra room.

Farm installations will cost 15s, plus 1s/point. For combined domestic and commercial premises the charge is much the same as for domestic premises. For commercial and industrial premises generally, the consumer will be charged according to the time taken for the inspection or, if preferred, in accordance with a quotation submitted before the inspection is carried out.

The Council also considered at its meeting the change in arrangements for payment of electricity accounts at banks. Consumers will still be able to pay their accounts in cash at banks, but only through the national arrangements made by the banks, which involve a fee of 6d paid by the consumer for each payment handled. Manweb also propose to discontinue the van collections which were previously provided by the N. Wales Power Co.

LIVERPOOL'S WATER AND PLANT POWER

THE possibility of installing power generating plant at the Liverpool Corporation's reservoir in the Tryweryn Valley has been under consideration by the city's Water Committee for some time. At one time it was suggested that the full capacity plant—about 3 MW—should be installed so that surplus electricity generated could be sold to the Merseyside and North Wales Electricity Board. The Committee recently suggested that only compensation water turbines and generators, of some 300 kW capacity, should be installed initially, although provision should be made for the possible installation of larger sets at some future date. But at last week's meeting of the City Council the proposal was withdrawn for further consideration. Binnie, Deacon and Gourley are consulting engineers for the scheme.

Permali apprentice school

A NEW apprentice school was opened at the Gloucester works of Permali Ltd. last week. With an area of 2,500 sq ft, the new school is divided mainly into two parts—a workshop and a lecture room. The former is fully equipped with machines, and the latter can accommodate up to 50 apprentices.

NO BOARD FOR EASTERN

The word "Board" will no longer appear on the showrooms, vans and notepaper of the Eastern EB. Brighter colours have been chosen, white on turquoise or turquoise on dark blue.

University Projects Axed

FIVE projects for universities—three nuclear reactors and two radio telescopes—are among the items temporarily suspended as the result of the Government's latest cuts in expenditure. The reactors suspended were scheduled for Scottish universities, Liverpool and Manchester universities, and London University. The radar telescopes were for Jodrell Bank and Cambridge University. The DSIR hope that the position will be reviewed later this year.

E.T.U. Reject Ultimatum

OBSERVERS close to TUC circles expect the ETU to be expelled as a result of their categorical rejection of the TUC's ultimatum to put their house in order. When the requirements were made a few days ago, suspension was mentioned as a direct possibility, but it is now believed that the general council of the TUC will wait until their annual Congress on 4 Sept., and then ask the member unions to expel the ETU. With such timing, disaffiliation would be likely to have the maximum impact on the ETU elections.

Of the three points in the TUC ultimatum, the ETU executive have made a concession concerning only one of them. They have postponed the operation of committees formed to take over most of the powers of the former pro-Communist general secretary. The other two points, that Mr Foulkes should resign as president and submit himself to re-election and that Messrs F. Haxell, R. G. MacLennan, J. N. Frazer, J. Hendy and J. Humphrey should all be debarred from office for five years, were rejected in full.

Bendix shift to Liverpool begins

THE first section of Fisher and Ludlow's new £3¼ million factory at Liverpool for the manufacture of Bendix appliances began production this week. Initial production is confined to certain models of washing machines, but it is hoped to transfer the whole of appliance manufacture from the car body works at Birmingham by the end of this year. Started only last May, Cubitts expect to complete the 422,000 sq ft factory in two months' time.

Appliance Price Rise Fairly General

MOST appliance makers are this week busily issuing new price lists to give effect to the Chancellor's 10% surcharge on purchase tax. At the same time they are keeping their fingers crossed that their sales will not suffer too much, with steeper hire-purchase charges as a result of the 2% jump in Bank Rate to add to their apprehension. EE and GEC are adding the full 10% surcharge right across the board, both saying "that is what the Chancellor intended." This is the general pattern, but some of the smaller groups are absorbing the extra cost on their luxury or more profitable lines, while raising the price on others.

AEI-Hotpoint are one of the main exceptions. Following their policy of pricing their products in round guineas, they are adding 1 gn on to most of their washing machines and 2 gn on to the more expensive Supermatic. Generally, this is a few shillings more than the actual surcharge. Faced with still further cutbacks in refrigerator production, however, they are holding all their refrigerator prices unchanged, even though the extra purchase tax will cost them between 14s 8d and £1 2s 2d per sale. Sales have evidently been going badly, for not only will the night shift cease this month, but a further 350 employees will become redundant at Peterborough next month.

Elsewhere in refrigerators the pattern is varied. Prestcold are absorbing the extra cost and Morphy-Richards are raising their compressor model only. But other makes besides EE and GEC will cost more; for example, Tricity, Jackson and Bendix.

Bendix are also applying the full surcharge on washing machines, with the exception of the Dynamatic, their cheapest model, which is also enjoying the economies of a long run. Hoover are passing on the increase on all their products, and Goblin are doing likewise. The smallest Goblin vacuum cleaner will go up from 14 gn to £14 18s 6d. Among heater makers, Sofono and Parkinson Cowan are passing on the increase all round, but Gatehill Beco are excluding their "Jetstream" and "Becosil 808" models.

Effectively, purchase tax on domestic appliances goes up from 25% to 27½% on wholesale price, but the increase is designated a "surcharge" and, being part of the Chancellor's newly acquired armoury of economic regulators, there is an inbuilt inference that it might be removed in future, not necessarily coinciding with an annual Budget. While it is too early yet to gauge the effect on sales, the stolidness of the appliance market in recent months suggests that it may not be great. Increasing the hire-purchase repayment period had no impact earlier this year, there was no rush last week to buy before the Chancellor's axe fell, and there may not be much difference now either.

Smith's Rationalisation

AS from 6 Aug., Smiths Aircraft Instruments Ltd., Kelvin and Hughes Ltd., Waymouth Gauges and Instruments Ltd. and Kelvin and Hughes (Aviation) Ltd., all subsidiaries of S. Smith and Sons (England) Ltd., will cease to trade as separate companies. Their activities are being embraced in a new division of the parent company to be known as Smiths Aviation Division, with administrative, executive and technical sales headquarters at Kelvin Hse, Wembley Pk Drive, Wembley.

P.T. FOR THERMAL STORAGE HEATING

THE uneasy truce that has existed between manufacturers of thermal storage heaters and Customs and Excise is likely to be ended; hitherto such heaters have not attracted purchase tax as long as they were sold for commercial and industrial use only. Now Thermodare have brought the matter to a head by announcing the introduction of a night storage heater specially for home use as from 1 Sept. Thermodare (Great Britain) accept the ruling that now all storage heaters will attract purchase tax including industrial models that have hitherto been tax free. This ruling will extend, we understand, to all industrial models made by other firms.

The availability of a domestic model night storage heater has long been needed, its introduction will be welcomed by the supply industry in extending the scope for off-peak load development. The new heater will be on sale only through electricity boards and recognised contractors.

U.S. BID FOR COSSOR

A CASH offer for the whole of the Preference and Ordinary shares of A. C. Cossor Ltd. has been made by the Raytheon Co. of the United States. Par value is offered for the Preference shares and 7s 9d for the 5s Ordinary. Grenfell and Co., who make the announcement, state that the offer will be subject to Treasury consent being received by 17 Aug. They state that the business would continue to be conducted as a separate entity. The board of Cossor's are considering the offer.

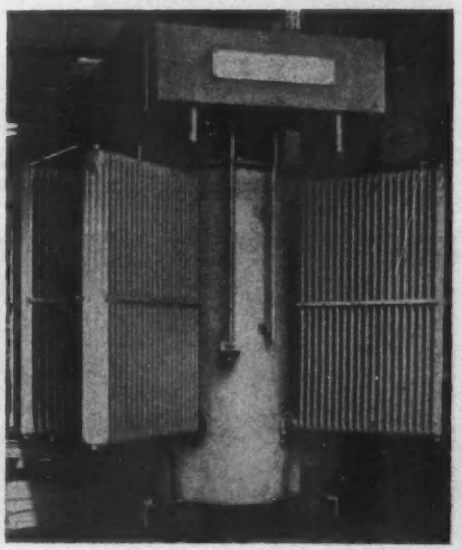
Delays in Scottish Electricity Report

THE committee on electricity supply in Scotland will not report so early as had originally been hoped. This was confirmed in the House of Commons last week by Mr J. Maclay, Secretary of State for Scotland. When he appointed the committee in March he said he hoped to have its report in six to nine months. Mr Maclay said he was currently considering with the North of Scotland HEB how its generation requirements over the next few years can best be met. He was not delaying this until he received the committee's report.

Arc Furnaces and Mains Flicker

ON page 116 of last week's issue, under the above sidehead, there appears the sentences ". . . of the order of $\sqrt{2}$ times the number of furnaces. More recently it has been suggested in the USA that the factor is $\sqrt{4}$ and not $\sqrt{2}$." This should, of course, have read ". . . of the order of $^2\sqrt{}$ of the number of furnaces. More recently it has been suggested in the USA that the factor is $^4\sqrt{}$ and not $^2\sqrt{}$." Similarly, on line 11 of this paragraph $\sqrt{2}$ should be $^2\sqrt{}$.

33/11 kV Transformer for New Zealand



This 7 MVA, 33/11 kV power transformer, photographed at the Treforest factory of South Wales Switchgear's Transformer Division before dispatch to New Zealand, is the first of seven identical units being supplied to the Hawkes Bay Electricity Power Board. New Zealand has for some time been one of the important overseas markets which altogether absorb more than 30% of the total annual production of South Wales Switchgear Ltd., and SWS equipment installed there includes 11 kV switchboards, control boards and a number of 33 kV Types E01 and E02 outdoor oil circuit-breakers

Developing Dip.Tech. in London

PLANS for developing Dip.Tech. courses in the London and Home Counties area are set out in a booklet published by the London and Home Counties Regional Advisory Council for Technical Education. Basis of the plan is that existing Dip.Tech. courses which are running satisfactorily should be developed up to an agreed figure of first-year enrolments.

The plan suggests figures for these "review points." For example, there are in the area Dip.Tech. courses in electrical engineering at eight colleges. These had a total first year intake of 185 students in the session 1960-61. The plan proposes that these courses should be allowed to develop to a first year intake of 370, and lists review points for each college. Existing proposals for new courses at Hendon and Kingston are to be considered in the light of enrolment for existing courses in 1961-62. If these additional courses were approved, total annual first year capacity would rise to 400 places, which should meet the needs of the area up to 1964-65.

In preparing the plans the Council has taken into account that industry cannot provide an unlimited number of training places, essential to the Dip.Tech. courses. Arrangements for courses to fit in with industry's requirements is essential. The report comments that it is unlikely that Dip.Tech. courses will be approved in colleges which have not been designated Colleges of Advanced Technology or Regional Colleges.

B.W.R.A. Annual Report

INCOME 12% up on 1959-60 at £263,379 and membership increased by 41 are highlights of the British Welding Research Association's annual report for 1960-61. Much of the contents refers to work in hand at the new laboratories, to which we referred on July 20. The president, Sir Charles Lillicrap, has been suggesting that someone else should take over his duties, but he has been prevailed upon to hold office for another year. Viscount Ednam and Mr W. Muirhead Watson have accepted an invitation to serve on the Council in place of Mr J. Brown and Mr T. M. Herbert. The DSIR have also nominated Mr G. A. McMillan in place of Dr Vernon as its representative on the Council. There have also been changes on the Research Board.

New Yorkshire Substation

ELECTRICITY supplies in the Denby Dale and Kirkburton areas of the Yorkshire EB have been reinforced by a new 66 kV substation. This was formally opened recently by the chairman of the Denby Dale UDC. Taking its supplies at 66 kV from a ring-main from Thornhill power station at Dewsbury, the 66 kV station has two 18·75 MVA Ferranti transformers stepping down to 11 kV for distribution purposes. The transformers are provided with oil circulating pumps, which give the station an emergency firm capacity of 23 MVA.

Switchgear and ancillary equipment by English Electric comprises an outdoor type 66 kV, 1,500 MVA o.c.b. and air-break isolators. 11 kV supplies are controlled from an 11-panel single-busbar metalclad indoor 250 MVA switchboard sectionalised into two halves. Brick walls and steel fireproof doors separate the two sections of the busbar.

A general view of the new Scissett 66/11 kV primary station of the YEB is shown below. The opening ceremony, left, shows Mr C. Booth, sub-area Manager, Councillor C. Stephenson, chairman, Denby Dale UDC, and Mr D. Bellamy, chairman, YEB

FIRST STEP TOWARDS E.E.C.

It shall be the aim of the Community to promote an harmonious development of economic activities, a continuous and balanced expansion, an increased stability, an accelerated raising of the standard of living and closer relations between its member states.

This extract from article 2 of the Rome Treaty shows the aims of the European Economic Community for which this country is to apply for membership. It is considered that negotiations may take some twelve months and any agreement will require ratification by all member states. In general this step of the British Government is one that will receive the support of most sections of the electrical industry. Already several sections of the industry are participating in their appropriate European associations.

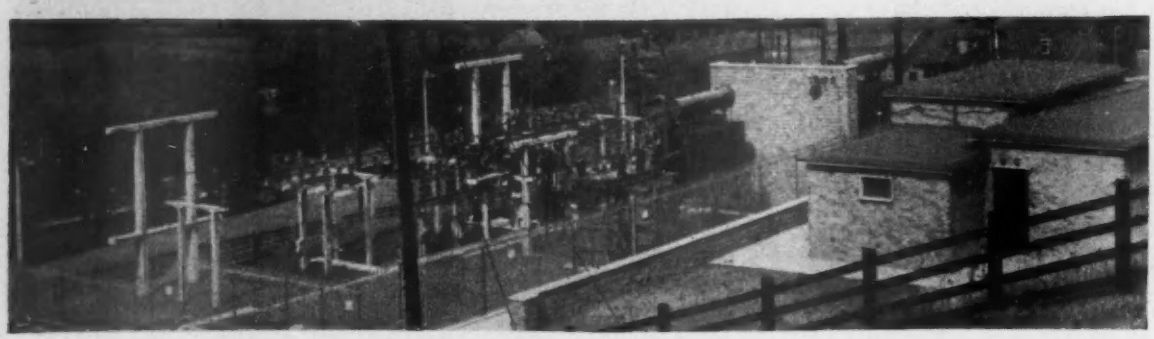
CRYPTON IN AUSTRALIA

CRYPTON Equipment Ltd., a company in the Metal Industries Group, are introducing their range of motor-car engine test equipment to the Australian market. For the purpose, they have formed a new company, Crypton (Australasia) Pty. Ltd. in equal partnership with Clyde Industries, who have extensive connections in the Australian car industry and are also prominent in heavy engineering. Based in Sydney, Crypton (Australasia) has a paid capital of £A60,000.

New Maker of Precipitators

A NEW manufacturer of precipitators for use in the electricity supply and other industries has appeared on the UK scene. This is the Western Precipitation Division of Joy-Sullivan Ltd., Newcastle mining machinery makers. The new division results from the merger in 1959 of Western Precipitation Corp. of Los Angeles with Joy Manufacturing of Pittsburgh, the parent company of Joy-Sullivan Ltd.

At Greenock, Western Precipitation Div. will make both electrical and mechanical types, chiefly concerned with the control and recovery of particulate matter in industrial gases.



U.S.S.R. PRIORITY ON ELECTRIFICATION

A USSR with the U for Utopia is presaged in the new party programme offered by Mr Khrushchev. The plan schedules an increase in industrial output within the current ten years by 150% to exceed the contemporary level of the USA. An increase of not less than 500% is predicted for the next 20 years. Electrification receives priority, with the whole country to be substantially completed before 1980, by which time annual electricity output must, the report says, be brought up to 2·7 to 3 thousand million MWh annually. By 1970, electricity output is to be 1 thousand million MWh and, by that time, Russia is forecast as being the world's leading industrial country. For higher living standards, the plan purposes increased payment, a six-hour six-day working week and complete secondary education for all.

Safety for Consumers

POWER for the Home Secretary to make regulations for the design and construction of all kinds of goods "to prevent the risk of death or personal injury" are granted in the Consumer Protection Act, now on the statute book. When regulations have been made, it will be an offence to offer for sale goods not complying.

Radio Sales Low

THE best thing that can be said about radio and TV retailing in May is that the summer decline in TV sales was less marked than usual. However, sales still only averaged four per shop against five last year. Radio sales were fractionally better than a year ago at an average of 12 per shop.

Dual Standards

TV sets which may be switched to either 405 lines or 625 lines will be seen at the Radio Show for the first time this year. Mullard have produced a dual-standard tube and 21 of the 24 receiver manufacturers will be demonstrating "switchable" sets. The show takes place at Earls Court from 23 Aug. to 2 Sept.

Sayings OF THE WEEK

"The unjustified things being said in this country about British industry as a whole are not only giving another weapon to our competitors overseas but creating yet another obstacle which thousands of people in this country who are trying to export have got to overcome." ... SIR WILLIAM MCFADZEAN, chairman, Export Council for Europe, writing to the *Financial Times*.

"I cannot imagine that anybody seeking to buy a 60-guinea washing machine will be deterred by the imposition of an extra guinea." ... MR J. DUNSE, director, Retail Distributors' Association, commenting on purchase tax surcharge.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, August 1

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	230½	−1
„ (3 months)	233¼	−1
LEAD, refined pig, 99·97% purity (cash)	65½	−1
„ (3 months)	66¼	−¼
TIN, refined, min. 99·75% purity (settlement)	920	+5
(3 months)	933	+8
ALUMINIUM, ingots 99·99·5%	186	—
„ wire bars (4×4×54")	193½	—
BRASS Strip 63/37	198½	—
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	78	−½
„ (3 months)	78¼	−⅝
RUBBER, per lb		
No. 1, RSS, spot	24½d	−⅛d
c.i.f. basis, ports, Oct.	24½d	−⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	69	—
Mild Steel Tape (0·04 in.)	53½*	—
NICKEL (home)	660	—
MERCURY (76 lb flask)	64	−1
AMERICAN PRICES:		
Copper, electrolytic (per lb)	31c	—
Lead (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

LARGE CONTRACTS AWARDED

A £75,000 order for electrical controls for a pulp mill at Stalinvaron, Hungary, has been awarded to Brookhirst Igranic. The order, placed by Lyddon and Co., of London, includes 15 motor control centres incorporating between 250 and 300 starters, mainly of the direct-on-line type, with a separate push-button station for each motor.

AGAINST severe competition from Common Market countries, AEI Motor and Control Gear Division has obtained an order for electrical equipment for the Titan Cement Co.'s works at Salonica.

PARMITER, Hope and Sugden Ltd. have received a valuable quantity order from the Water and Electricity Board of Valetta, Malta, for ironclad 30 A and 60 A service fuse boxes.

A 6,450 kW back-pressure turbo-alternator set has been ordered from W. H. Allen Sons and Co. by Peter Dixon and Co. for their West Marsh Paper Mills, Grimsby.

AEI Lamp and Lighting Co. have supplied 2,800 fluorescent lamps for Marks and Spencer's new store in Market St, Manchester. The order includes over 1,400 8 ft 125 W and 1,000 5 ft 80 W natural fluorescent tubes.

SWITCHGEAR orders worth £1,200,000 have been placed with AEI Ltd. by the CEGB. For an outdoor switching station at Lovedean, near Portsmouth—a transforming point on the supergrid line from Dungeness—the company is to supply 19 air-blast circuit-breakers, three rated at 275 kV, 15,000 MVA and 16 at 132 kV, 3,500 MVA, together with outdoor isolators and associated control equipment. For a new switching station in Gloucester, three 275 kV, 15,000 MVA and two 132 kV, 3,500 MVA air-blast circuit-breakers are to be supplied. This site will eventually become a four-switch box-mesh station.

New Orders Subside

THE bout of ordering for large power stations by the CEGB having subsided, new orders received in May by the engineering and electrical goods industries were much below the level of the three preceding months. The shortfall against April was 18%. But compared with a year ago, the influx of orders for the combined industries was only slightly lower. The result is that orders on hand at the end of the month were 15% higher than a year earlier, even though deliveries have been running at a higher level and in May were nearly 5% higher than in May, 1960.

Exports have been making their full contribution. New orders were 19% higher in May than in April, and compared with a year earlier, orders on hand were 11% higher. This is offset to a small extent, however, by the value of deliveries being 3% lower than a year earlier.

Production, while estimated to be a shade below April, continued at a high level. May's output is estimated at 3% higher than that of May, 1960, and, taking the first five months of the year as a whole, production is 4% higher than last year.

News in Brief

The 1962 Brussels International Fair is to open on Saturday, 28 April, instead of 30 April as has been previously stated. The change is to avoid week-end stand erection charges to exhibitors.

The British Mining Equipment Export Association will have a stand in the BoT Pavilion at the Zagreb International Autumn Fair.

A. H. Hunt (Capacitors) Ltd. will be holding an exhibition of their products in the Sun Lounge of Kensington Close Hotel, Wrights La, W.8, on 23 Aug. and 24 Aug.

Maximum price of many types of nickel-bearing alloy and stainless steels had been raised by 31 July, the Iron and Steel Board has announced.

To place underground the existing overhead lines around the stone circle at Avebury will cost £3,200. The Southern Electricity Board has offered to bear half the cost, Wiltshire CC will provide £800 and the National Trust the remainder.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Maritime Grid

The Crown-owned Northern Canada Power Commission will spend $4,751,000 in New Brunswick during the fiscal year ending 31 March, 1962, it was announced in the Commons recently. This will include transmission lines between Newcastle and Bathurst, Grand Lake and Newcastle and Beechwood and Fredericton, and a terminal station in Bathurst. The work comes under the Atlantic Provinces Power Assistance Act. The projects are part of the Maritime power grid.

DOMINICAN REPUBLIC

HE Studies

The first of three hydro-electric studies announced this year in the Dominican Republic is now being carried out by the Government. This is the Las Damas dam and irrigation project in the southern area of the country. The total cost of this dam is estimated at $13·5 million and an annual output of 50 million units is expected.

S. AFRICA

More Cape Town Orders

Orders for additional plant for the "A" extension of Cape Town's Athlone power station are about to be placed. The plant comprises No. 5 turbo-alternator and No. 7 boiler, together with ancillary plant and equipment. Capital cost is estimated by the city electrical engineer, Mr C. G. Downie, at £935,000. When tenders for the initial plant for this extension were called for some time ago, the City Council also asked for options for the next instalment. It has now been decided to exercise these options, which have already been extended and are expiring, instead of waiting several months before inviting fresh tenders with the almost certain possibility of higher prices being quoted than those the Council has in the options. The main items of the new plant will be a 30 MW turbo-alternator set, to be supplied by Oerlikon Engineering Co., for £256,000 —subject to a ceiling adjustment of 12%; a 260 klb/hr boiler by John Thompson Africa Ltd., £359,000—subject to ceiling adjustment of 8%; condensing plant for the turbo-alternator, Metropolitan Vickers Electrical Export Co., £76,742—subject to adjustment; circulating water pump, W. H. Allen Sons and Co., £12,435—ceiling adjustment 12%; piping for turbo-alternator and feed pump, Aiton Africa Ltd., £76,881—ceiling adjustment 5%; 66 kV switchgear extensions, A. Reyrolle and Co., £21,309—ceiling adjustment 7½%; auxiliary switchgear extensions, English Electric Co. of SA Ltd., £18,350—ceiling adjustment 12½%; and cables and accessories, British Insulated Callender's Cables, £21,337. Among other orders being placed are those for extensions to the dust handling plant (£9,360) and vacuum cleaning plant (£2,191), John Thompson Africa Ltd., and extensions of the ash handling plant (£7,956), Robins Conveyors (SA) Ltd. In addition, three auxiliary transformers (£6,378) will be obtained from Yorkshire Electric Transformer Co. Ltd.

MAURITIUS

Development Projects

In addition to the commissioning of two new hydro-electric stations, extra thermal generating capacity is to be provided in Mauritius together with the rebuilding of the cyclone-destroyed hydro station at Cascade Cécile. Of the hydro plants, the Magenta station which was formally opened by H.E. the Governor, earlier this year, has a 1,000 kW Gilkes Francis turbine and Bruce Peebles alternator. Remotely controlled from Tamarind Falls station further upstream, the discharge water is conveyed by pipeline to provide a head of 150 ft at the new station. In the second new hydro station, Eau Bleue, two 2,000 kW Gilkes turbines and English Electric alternators will operate under a head of 600 ft. Drawing water from a newly constructed reservoir of 216 million cu ft capacity, the plant is expected to have an annual output of 18 million units. The Central Electricity Board of Mauritius has also decided to build a thermal station at Fort George, Port Louis with an ultimate capacity of 42 MW. Construction work has already started, and two 6 MW diesel sets have been ordered from Fiat, of Turin, for commissioning in 1963. This project is being carried out by the Board's consultants, Preece, Cardew and Rider. The small hydro station at Cascade Cécile, which was destroyed in last year's cyclones, is to be replaced by a larger station further downstream. To be built with local resources, the station, also due for commissioning in 1963, will have a capacity of 1,000 kW and an annual output of 4 million units. The CEB have also approved plans for the reconstruction of several urban distribution systems severely damaged by the cyclones, together with the erection of new 66 kV and 22 kV transmission lines across the island.

INDIA

Railway Order

Another £1 million contract for further railway electrification in the Calcutta area has been awarded to British Insulated Callender's Cables Ltd. by the India Railway Board. This latest contract, the third received by BICC from the same source since December, 1958, covers the supply and installation of over 250 track miles of overhead equipment for 25 kV 50 cycles a.c. suburban lines. It brings the total length to nearly 1,000 track miles, and the cost to about £4·7 million. The new scheme includes areas to the north and north east of Calcutta, and Sealdah, south of the city.

MALAYA

Remote Village Scheme

One good result of the recent war against Communist guerrillas in the Malayan jungle is the order just placed by the Central Electricity Board of Malaya for 62 diesel generating sets, each of 28 kW, for its peninsular electrification scheme. In the war against the bandits, remote villages were cordoned off with barbed wire fences and floodlights, and look-out towers to prevent incursions at night. To supply the power needed, all suitable generators were pressed into service, and these also provided electricity for use by the natives, many of whom had not previously had that pleasure. But electricity has become an essential to village life now and, with the protecting lights no longer necessary, the sets are used solely for supplying the natives. From this beginning, the CEB have established a peninsular electrification scheme and the new sets just ordered are to be installed in more of these remote villages. The new sets comprise Ruston and Hornsby three-cylinder 43 b.h.p. air-cooled engines driving Lancashire Dynamo 50 cycle, 28 kW 400/440 V alternators, with switchgear by Guthrie.

AUSTRALIA

Queensland's Plan

Major proportion of the finance for construction of two new power stations in Central Queensland, to which we referred on 6 July, is now expected to be provided by the State Electricity Commission and the Southern Electricity Authority. Earlier, the State Premier implied that an approach would be made to the World Bank. It is understood the Government will proceed with the electricity extension programme without waiting for Commonwealth approval of special loan raising. Sites of the new stations will probably be at Callide and on the West Moreton coalfield, the latter station being the responsibility of the Southern Electricity Authority. The decision to proceed with the two stations is based on the report submitted by Merz and McLellan. Their original recommendation was for a major powerhouse at Callide, but this has been amended.

Company Activities

FOR one day at least last week it looked as if stock markets were intending to shrug off the gloom of the Chancellor's "Little Budget"—and that day was the day immediately following the announcement of his proposals. In fact, the *Financial Times* industrial ordinary index recorded an 0·8 rise to 316·0. GEC, Plessey, Thorn, Decca "A," Reyrolle and a number of others in the electrical market all went better. And then the "Little Boom" burst. Mr Isaac Wolfson decided to harken unto the Chancellor's plea for dividend restraint and declared a smaller final payment to make it a same again total for the year on the shares of his Great Universal Stores. Tension hung ominously over Berlin and, generally, second thoughts on the measures of Tuesday, 25 July, brought about a dramatic *volte-face* in markets with the FT index plunging no less than 8·7 points to 307·3. Down, too, went the majority of electrical shares, although over the week Berry's Electric Magicoal were 1s 3d up on the chairman's statement at 47s. Thorn were 1s dearer at 47s 6d on the results and A. C. Cossor saw their 5s Ordinary shares spurt 2s a time to 7s 4½d on the American takeover bid.

Eagerly awaited, the accounts of GEC still leave the market guessing as to the company's trading experience since its year started on 1 April, 1961. New chairman Mr A. Lindley, after last year's fall in net profit after tax from £2,532,384 to £1,377,677, promised, however, that he will provide "up-to-date information regarding matters of importance" at the yearly meeting. At a Press conference last week he made it clear that insufficient time has passed since the "Little Budget" for him to forecast the consequences for GEC. Even so he confirmed that the company intends to carry through its resolve to build up on the domestic appliance side.

A more urgent matter, however, has been the build up in the group's overdraft from £426,422 to £11,236,396 at 31 March. This has been brought about by the considerable increase in stocks of raw materials, work in progress and manufactured goods which is largely associated with atomic and other heavy engineering contracts. But now that the group will have to pay over and above the 7% Bank Rate for these overdraft facilities it must certainly be reduced; and this Mr Lindley affirmed last week. My question to him on whether it was planned to raise fresh capital in order to eliminate or reduce the burden brought the reply, "not at the moment." We can, however, expect some enlargement upon this topic at the annual meeting. In passing, the Chancellor might note that bank money borrowed by GEC to finance its overseas customers is charged at Bank Rate plus 1%. How Mr Lloyd thinks an 8% financing charge will assist the country in its prime problem of pushing up exports is worth elaboration.

Mr Lindley is confident that GEC will go ahead under its new direction (an employee to whom I spoke said already the effect of "decision" in the company's affairs is being felt), but he pointed out it will have to go very much hand in hand with the nation's prosperity as a whole. As far as the company's £1 Ordinary shares were concerned last week, however, prosperity was a little clouded, for after starting out at 30s 10½d they finished 10½d sadder at 30s. It is to be noted, at the same time, that Mr Lindley still has hopes of an unchanged 10% total dividend for the year.—*From our City Correspondent.*

company next July. Only money deposited up to the end of the present month will qualify the lender for prior allotment of shares at the time of the flotation, they add. The deposit scheme, reported by the ELECTRICAL TIMES on 1 June, is for loans of £25 or over at 10% interest, with a quarter redeemable on demand and the remainder at one month's notice.

General Electric Co.

Nothing has happened to alter the board's expectation of a 10% dividend again this year, Mr A. L. G. Lindley said at a Press conference to launch the report and accounts last week. However, statements concerning trading since March were reserved for the annual meeting on 7 Sept. It was still too early to say what were likely to be the effects of the Chancellor's new measures, but prices of the group's domestic appliances were likely to rise marginally. Other interesting points were that there have been no financial or basic technical problems in connection with the Tokai Mura nuclear power station in Japan, and the question of any merger with EE remained completely dead. He also denied a rumour that GEC was going to cease domestic refrigerator production. Efforts would be made to reduce the £11 million overdraft built up in the past year. On the long-term future, he and the board had full confidence. That the heavy engineering, appliance and radio-TV sectors were responsible for the virtual halving of net profit was already known. The report also shows which were the brighter spots. Profits rose in Osram, semiconductors and most home and overseas subsidiaries. Reorganisation affected returns in some sectors and better results can now be expected.

Year to 31 Mar.	£ Trading Profit	£ Net for Parent	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1957	9,621,161	2,436,213	21·7	12½	59/3	37/3
1958	9,040,341	1,655,664	14·1	10	40/3	29/3
1959	9,353,814	2,001,379	16·5	10	50/6	30/-
1960	11,073,872	2,327,281	19·2	10	47/9	29/-
1961	9,519,072	1,361,355	10·5	10	40/3	29/1

Colvern

After last year's record both at home and overseas, sales have continued at a "satisfactory" level in the current year, the chairman reports.

Dubilier Condenser

An £86,277 drop in trading profit to £266,444 for the year to March is not unreasonable in view of the recession in demand for TV components, the chairman states. As demand is not improving in this sector, maximum efforts are being made to increase sales in the electronic, industrial and export divisions. Already announced, dividend is 15%, the same equivalent as for the previous year.

Electrical Components

A good effort for electrical wholesalers in prevailing conditions, dividend is raised by 1% to 12½%. Preliminary figures show trading profit £9,392 higher at £352,203, but higher tax reduces net profit to £167,722, against £170,684 previously. Ordinary dividend absorbs £69,817 net, and Preferences £3,369.

Electric Construction Co.

The shortage of skilled manpower seems to have been overcome to some extent. At the annual meeting last week, the chairman said that production for the first quarter of this year showed an "appreciable increase," but competition at home and overseas was still severe.

A. J. Flatley

Following some unfavourable Press comment on their deposit-seeking scheme while being a private exempt company, not required to distribute a balance sheet, Flatley now say they have definitely decided to become a public

George Kent

A final dividend of 6% makes 8½% for the year, which is the same equivalent as previously. Parent net profit is up from £381,742 to £400,222, but group results come out at £323,319 (*£307,061*).

Harper Engineering and Electronics

It is clear that group profits for the year to 30 June, 1961, will be lower than for the preceding year, the chairman discloses. Provision has to be made for certain non-recurring losses.

Metal Industries

At £2,436,043 before tax, group profit is described by directors as "not unsatisfactory in face of current trends," a verdict with which most investors will no doubt agree. The earnings compare with a forecast of £2·5 million made at the time of the rights issue in May, 1960, and repeated in November, but

include an exceptional £96,387 from a change in basis of valuation of stocks and work-in-hand of certain subsidiaries. Because the latest results include the earnings of companies in the former Lancashire Dynamo group for 15 months and the Alcol (Australia) group for nine months, the previous year's earnings of £1,722,715 are not comparable. After tax, latest net profit is £1,396,249 (*£887,561*).

Oldham and Son

Group net profit, after tax, is up from £222,593 to £297,583, and a final dividend of 10% brings the total up to the 17½% forecast.

Parkinson Cowan

A major purchase in the industrial heating field is under negotiation as part of the plan to reduce dependence on domestic appliances, the chairman reports. On the financial position, he says an £870,539 overdraft demonstrates the need to raise capital at a later stage.

Parmiter, Hope and Sugden

Higher earnings in the past year were the result of a considerable increase in turnover. Directors say in their report with the accounts that, in money terms, the order intake was higher than ever before, and as a result the order book at the end of the year was one-third higher than 12 months earlier.

Solartron

Directors have decided not to sell their shares to Firth Cleveland at the £3 offered. Firth Cleveland, who already own 46·7% of the ordinary capital, have made the bid for the remaining shares under the terms of an agreement made last year.

Thorn

Despite the difficulties of the radio and TV industry, trading profit has increased from £3,916,990 to £4,113,907, giving the share market a pleasant surprise. After tax, net profit is slightly higher at £1,548,769 (*£1,525,988*), comfortably covering a steady 25% dividend. Directors make no comment with the preliminary figures, but it would appear that Atlas Lighting must have had a good year indeed.

Ultra

Prospects for the current year, and next, are promising, the chairman reports. The order book is larger than a year ago, and concentration on electronics makes planning more reliable. Mr Rosen adds that future earnings depend to a large extent on the amount invested in research and development. In this connection, it is noteworthy that the arrangement for an exchange of information with 18 US companies is now taking effect. Of Ultra's 2,000 employees, 400 are engaged on technical development.

Ward and Goldstone

The company may well be on the way to another record profit this year. At the annual meeting, Mr Sampson Goldstone told shareholders that sales for the first quarter of the current year exceeded those for the previous year.

Watsham's

Trading profit is halved at £35,164 for the year to March, against £69,960 previously, but dividend is held at 15%. Net profit comes out at £13,418 (*£38,612*). The parent company's earnings were £15,000 lower due to bad weather and intense competition in contracting, but an even greater drag on results stemmed from the Pigeon Hole Parking venture, which the J. Glover subsidiary are instituting.

Westinghouse Brake and Signal

Declaring an interim dividend of 2½% instead of waiting to the end of the year as usual, Directors say profits are running at a materially lower rate. Unless trade deteriorates further, they still expect to hold the 11% rate.

Wilkins and Mitchell

Pre-tax profit slumped from £1,087,108 to £304,766 in the year to March, and dividend is slashed from 21% to 12%. This result would not be surprising from an appliance maker, even if directors had not given a warning last January. After tax, net profit is down from £535,810 to £155,870.

NEW LITERATURE

Directory of Opportunities for Qualified Men

THE first 30 pages of the 1961 edition of this book outline opportunities in industry in executive posts and abroad for qualified men and, rather contradicting the title, a further chapter refers briefly to opportunities for qualified women. Probably the most useful section of the book is the subsequent 12 pages summarising executive courses planned for the current year. The remainder of the book is devoted to a series of advertisements for selected firms and Government and public bodies. Perhaps not unexpectedly, except for public posts, no indication is given of salaries payable. Cornmarket Press Ltd., 155 pages, 8¼ in. by 5½ in. Price 8s 6d, full-bound, or 5s, paper-backed.

Copper for Radiant Heating

THIS latest addition to the publications of the Copper Development Association deals with embedded radiant panel heating using hot water pipes or electrical cables. The electrical section of the book discusses floor-warming installations in some detail, with attention to loadings and to installation techniques. A set of charts is included relating to cable length and spacing to heating intensity and total heating cable loading. There is also a helpful chapter on floor and ceiling construction, which gives attention to wall panel heating as well as floor-warming. Extensive tables of heat transmittance characteristics and typical room temperature and air change figures add to the value of the book. Published by the Copper Development Association, 78 pages, 6 in. by 8½ in. Gratis.

Complex Variables and the Laplace Transform for Engineers

by W. R. Le Page

YET one more addition to the ever-expanding bibliography of transform mathematics, this major work by the chairman of the electrical engineering department of the Syracuse University is a full treatment of the subject, again based on a university course. Although the title would seem to indicate that it is intended for the engineer, the treatment has obviously been directed to the viewpoint of the student of mathematics wishing to become an engineer rather than for the engineer seeking to extend his knowledge of mathematics. In the preface it is stated that, "because of the lack of generality in the proofs, this should be regarded as an engineering book, in spite of the extensive use of mathematics." Yet, of the many problems set, only a few have any engineering flavour, the majority coming straight from the mathematical concept of what should constitute "a problem." Which only shows the vast gap that still exists between the mathematician and the practising engineer. It is a student's textbook and, as such, undoubtedly an excellent one. But for the engineer?—hardly! Published by McGraw Hill, 470 pages, 9 in. by 5¾ in. Price 97s.

BOOKS RECEIVED

Fumifugium: or the Smoake of London Dissipated, by J. Evelyn. Reprint by the National Society for Clean Air of the famous diarist's work, to mark the tercentenary of its 1661 publication. Published by the Society, 41 pages, 8¼ in. by 5½ in. Price 2s 6d.

The Distribution of Flux and Temperature in Thermal Reactor Fuel Rods, by I. S. McGill. Compares an approximation for calculating flux in cylindrical fuel rods with experimentally measured values. Published by H.M.S.O., 22 pages, 10¼ in. by 8¼ in. Price 3s 6d.

Introduction to Transients, by D. K. McCleery. Study using the simple approach of the Heaviside operational method instead of the mathematically more rigorous Laplace transform. Textbook for I.E.E. Part III examination and Dip.Tech. course. Published by Chapman and Hall, 232 pages, 8¼ in. by 5¼ in. Price 42s.

Definitions and Formulae for Students—Modern Physics, by L. R. B. Elton and Daphne F. Jackson. Compact summary of basic formulae of advanced physics covering wave mechanics, relativity, nuclear physics and electronics. Published by Pitman, 44 pages, 5½ in. by 4¼ in. Fourth edition. Price 2s.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

3 Aug.—Dudley C.B.C. Erection of 750 tubular steel columns complete with post-top lanterns/gear and installation of 500 lanterns/gear on existing columns.—See 20 July issue.

4 Aug.—Belfast C.C. (b) Electrical installation in Diagnostic Centre and caretaker's residence, Greenwood Hse, Upper Newtownards Rd.—See 20 July issue.

4 Aug.—Edinburgh C.C. Electrical installation in Leith Clinic, 5 Links Pl. Applications to City Architect, City Chmbrs, by above date.

4 Aug.—Leyland U.D.C. Contract 33. Electrical installations in 48 flats, Lower Hse estate.—See 27 July issue.

4 Aug.—Newcastle upon Tyne C.C. (c) Electrical installation, on fixed-price basis, in Firfield Secondary Boys' School, Firfield Rd.—See 27 July issue.

5 Aug.—Chilton P.C. Supply of 12 Class "B" concrete columns, lanterns, 80 W discharge lamps/gear.—See 27 July issue.

7 Aug.—Cookstown R.D.C. Wiring installations in (a) ten houses at Annaghmore and (b) 20 cottages on various sites. Council Clerk, J. M'Cammon.

7 Aug.—Laoighis-Offaly. Electrical installation alterations and extensions at St. Fentan's Hospital, Portlaoighis, for Mental Health Board.—See 27 July issue.

8 Aug.—Breconshire C.C. Electrical installation in 64,500 sq ft five-stream comprehensive school, Brynmawr.—See 27 July issue.

8 Aug.—Ely R.D.C. Electrical equipment of bungalows: six at Littleport; two at Mepal; four at Stretham; three at Little Thetford; and three at Wilburton.—See 27 July issue.

8 Aug.—Hawick B.C. Supply of steel columns and mercury vapour lighting for 26 units along A7, Buccleuch Rd.—See 20 July issue.

8 Aug.—Manchester C.C. Supply and installation of announcement system in new terminal building, Manchester Airport.—See 27 July issue.

9 Aug.—Sittingbourne and Milton U.D.C. 150 Group "B" 80 W mercury vapour lighting on concrete columns.—See 27 July issue.

9 Aug.—Taunton B.C. Rewiring of 132 houses, Lambrook estate, and 54 houses, Wedlands estate. Hsg Maintenance Superintendent, H. G. Cox, Lambrook Farm Depot, Priory Ave.

9 Aug.—Wortley R.D.C. Supply and installation of street lighting in five groups. (1) 93 15 ft columns with 80 W mercury lamps; (2) 31 20 ft columns with 125 W lamps; (3) 26 25 ft columns with 3 x 80 W fluorescent tubes; (4) 68 25 ft columns with 250 W mercury lamps; (5) 77 20 ft and 15 ft columns with 125 W and 80 W mercury lamps.—See 29 June issue.

10 Aug.—East Riding C.C. Electrical services installation in County Secondary School, Fulford.—See 27 July issue.

11 Aug.—Midlothian C.C. (1) 63 140 W sodium units on concrete columns along A7 near Newtongrange and A68 near Dalkeith. (2) Nine 140 W sodium units/concrete columns on B6455.—See 20 July issue.

12 Aug.—Leeds (A) Gp. Hospitals. Applications invited for inclusion in approved list.—See 27 July issue.

12 Aug.—Oxford C.C. Supply: electrical goods for Cutteslowe Court Old People's Home, Jackson Rd.—See 20 July issue.

14 Aug.—Birmingham Tame and Rea. Supply of thermoplastics and p.i.w.a. cables. Engineer, District Drainage Board, Rookery Pk, Erdington, Birmingham.

14 Aug.—E.B. for N. Ireland. 400 V switchgear for Coolkeeragh Power Station.—See 22 June issue.

14 Aug.—E.B. for N. Ireland. 33 kV 750 MVA metal-clad indoor switchgear.—See 13 July issue.

14 Aug.—Hollywood U.D.C. Provision and erection of 43 2 x 40 W fluorescent street lighting lanterns. Surveyor, Council Offices.

14 Aug.—Knutsford U.D.C. Supply and erection of 23 Group "A" steel columns/lanterns; removal of six existing columns, and the exchange of 46 vertical 250 W m.v. lanterns by horizontal 250 W m.v. units. Surveyor, Council Offices, Toft Rd.

14 Aug.—Mossley B.C. Fixing and wiring of 125 Group "B" lanterns/gear and time switches. Borough Surveyor, Town Hall.

14 Aug.—N.I. Hospitals Authority. Electrical installations in staff houses at Tyrone and Fermanagh Hospital.—See 27 July issue.

15 Aug.—Cardiff C.C. Supply and installation of service lift at Canton Sub-divisional Police Station.—See 27 July issue.

15 Aug.—Clonmel. (b) Electrical installation comprising main switchboard, 184 lighting, 114 socket, three cooking and 29 power outlets, fire alarm and telephone system in Clonmel Technical School, Co. Tipperary. Details from consulting engineers, J. A. Kenny and Ptnrs., 44 Kildare St, Dublin. Deposit £10 10s.

16 Aug.—Piltown. Electrical installations in existing and new buildings, Oblate Scholasticate, Piltown, Co. Kilkenny. Installation consists of 741 lighting, 112 socket, three power and three cooker outlets, telephone and fire alarm systems and main switchboard. Details from consulting engineers: J. A. Kenny and Ptnrs., 44 Kildare St, Dublin 2. Deposit £5 5s.

17 Aug.—Down C.C. Heating and lighting installation in new clinic and library, Braniel. Details from consulting engineers, McCandless and Barton, 6 Murray St, Belfast 1. Deposit £2.

18 Aug.—Haslingden B.C. Rewiring of power circuits and incidental works in 20 houses and eight flats, Cedar Ave.—See 27 July issue.

18 Aug.—Hornsey B.C. Supply and erection of 72 200 W sodium units on 30 ft steel columns and 46 140 W sodium units on 25 ft steel columns together with the removal of existing lighting along A1, Archway Rd, A1000, Gt. North Rd, and B640, Hornsey La. Borough Engineer and Surveyor, Town Hall, Crouch End, N.8.

18 Aug.—Londonderry C.C. Wiring old people's home, Moneymore.—See 13 July issue.

18 Aug.—Tottenham B.C. Stage IX lighting improvements: (a) supply and erection of 1,090 Group "B" concrete columns/brackets; (b) supply of 60 W sodium lanterns; (c) supply of 60 W sodium control gear. Borough Engineer and Surveyor, Town Hall, N.15. Deposit £2.

19 Aug.—Fife C.C. Supply of 38 Group "A" steel columns, sodium lanterns, etc., for roundabout lighting. County Surveyor, "Belfield," Cupar.

19 Aug.—Saltburn and Marske U.D.C. Supply by overhead cables to, and interior installation in three toilet blocks at Caravan site.—See 27 July issue.

19 Aug.—Selkirk C.C. (2) Electrical work in 88,000 sq ft Galashiels Academy. Applications to J. and J. Hall, Ladhope Vale, Galashiels, by above date.

21 Aug.—Crickhowell R.D.C. Provision and erection of 35 steel columns/sodium lamps/lanterns along A40. Surveyor and Public Health Inspector, R. A. Jackson, Council Offices. Deposit £3 3s.

21 Aug.—East Kesteven R.D.C. Contract 2: two 375 g.p.m. and two 125 g.p.m. sewage pumps and one 100 g.p.m. sludge pump. Contract 3: two 30 g.p.m. ejectors, all to be complete with motors, starters and accessories for Heckington and Gt. Hale sewerage scheme.—See 27 July issue.

21 Aug.—Enniskillen R.D.C. Water pumping plant for Marble Arch scheme.—See 13 July issue.

21 Aug.—Heston and Isleworth B.C. Rewiring, etc., 40 houses, Warren estate, St. Aubyn's Ave.—Advertised 27 July issue.

21 Aug.—Ilkley U.D.C. Rewiring of 65 houses.—See 27 July issue.

21 Aug.—North Riding of Yorks C.C. Mercury vapour lighting at two roundabouts. County Surveyor, County Hall, Northallerton.—Advertised in this issue.

24 Aug.—Hoylake U.D.C. Supply of 208 140 W sodium lamps/gear for Group "A" conversion scheme using existing 25 ft steel columns. Engineer and Surveyor, 8 Riversdale Rd, West Kirby, Wirral.—Advertised in this issue.

25 Aug.—Braintree and Bocking U.D.C. Wiring, on fixed-price basis, of two groups of 28 houses, Wheatley Ave.—See 27 July issue.

25 Aug.—Ellesmere Port B.C. 38 Group "A" and 146 Group "B" street lamps and re-

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 115 queries answered this week

"Ritter" dental machine motors—address for spares? G. and H.—L. Porro Ltd., 117 Gt. Portland St, W.1.

"O.T.I.E." vacuum cleaners—makers of? Y.E.B.—Office Technique Industriel "Express," 13 Rue des Fusilles, Puteaux, Seine, France.

"Rodene" time switches—suppliers of? W.C.—D. Robinson and Co., 717 London Rd, Hounslow, Middx.

Wall-mounting vibratory massage belt—makers of? E.E.B.—F. W. Read and Sons Ltd., 175 Gray's Inn Rd, W.C.1.

"Qray" heated compress—makers of? J.L.—Radium Electric Ltd., 7 Queen's Rd, Haywards Heath, Sussex.

"Angelus" electric fires—address for? T.E.—Sperryn and Co. Ltd., 23 Great Suffolk St, S.E.1.

"Wallis" refrigerators—address for spares? K.E.S.—Acre Refrigeration Co., 389 Green Lanes, N.4.

"Therglass" electrically heated glass—makers of? B.D.—Young and Power Ltd., 55 Mainway, Alkrington, Manchester.

"Soldex" Soldering irons—address for? P.R.—Associated European Sales and Co. (G.B.) Ltd., 6 Bloomsbury Sq, W.C.1.

moval of nine Group "B" and 109 gas lamps.—See 20 July issue.

26 Aug.—Bradford B.C. Installation of electric wiring, three dwellings, Scar Hse Reservoir, Harrogate.—See 29 June issue.

26 Aug.—East Barnet U.D.C. Contract 941. (a)(i) Supply and erection of 13 15 ft concrete columns/brackets and 37 c.i. columns/brackets; (a)(ii) resiting of 139 15 ft metal columns and erection of 116 15 ft metal columns; (b) supply and fitting of 395 60 W sodium lamps/lanterns/gear; (c) wiring of columns and lanterns. Engineer and Surveyor, Town Hall, Station Rd, New Barnet. Deposit £2 2s.

28 Aug.—Bury St. Edmunds B.C. Inspection of electrical installations in 65 temporary dwellings.—See 27 July issue.

28 Aug.—Welwyn Gdn City U.D.C. Erection and/or painting of 82 steel lighting columns/lanterns and removal of existing columns in town centre. Engineer and Surveyor, Council Offices.

29 Aug.—Cardiff C.C. Supply and installation, on fixed-price basis, of passenger lift in aged persons' home, Newborough Ave, Llanishen. City Architect, Greyfriars Rd. Deposit £2 2s made payable to Corpn.

1 Sept.—Belfast C.C. Specification W.198. Supply and erection of 33 kV switchgear, together with modification of existing plant. Electricity Dept., East Bridge St, Belfast 1. Deposit £2 2s.—Advertised in this issue.

1 Sept.—N. Armagh Hospitals. Electrical work in Lurgan and Portadown Hospital alterations and additions. Details from consulting engineers, McCandless and Barton, 6 Murray St, Belfast 1. Deposit £5 5s

1 Sept.—Thurrock U.D.C. Erection of columns included in road improvements, Heath Rd and Long La.—See 27 July issue.

4 Sept.—N. Ireland E.B. Main generator/generator transformer connections for No. 4 60 MW turbo-generator.—See 6 July issue.

5 Sept.—Athlone U.D.C. Supply and installation of two pumps with capacity of 11 cu ft p.m. for main drainage pumping plant. Details from consulting engineers, P. H. McCarthy and Son, 26 Lower Leeson St, Dublin. Deposit £5 5s.

18 Sept.—E.B. for N. Ireland. Specification N.I.1638. Supply of two 200 kVA and two 300 kVA 3·3/0·4 kV transformers for Coolkeeragh Power Station.—See 27 July issue.

No date stated—Huddersfield C.B.C. Electrical and passenger lift installations together with supply and installation of kitchen equipment in home for aged, Reinwood. Borough Architect, High St Bldgs.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

8 Aug.—Canada. 5 kV metal enclosed switchgear for Manitoba Telephone System Admin Bldg. Chairman, Committee of Utilities and Personnel, 185 King St, Winnipeg 2. B.o.T. (ESB/24088/61).*

15 Aug.—Egypt. 11 kV and 3·3 kV substations at Kalyou and at Zagazig, Waste Cotton Spinning Mills. Details from Tennant Guaranty Co. Ltd., 4 Copthall Ave, E.C.2. B.o.T. (ESB/24021/61).*

15 Aug.—Singapore. Transformers, 6·6/·433 kV (3 items). Electricity Dept., City Council. B.o.T. (ESB/23785/61).*

16 Aug.—Kuwait. Elements for water heaters, immersion heaters, thermostats and portable fires. President, Dept of Electricity, Water and Gas. B.o.T. (ESB/24078/61).*

17 Aug.—Pakistan. Train lighting lamps. Controller of Purchase, P.W. Railway, Empress Rd, Lahore. B.o.T. (ESB/24050/61).*

5 Sept.—Nigeria. Two 7·5 MVA, 33/11 kV transformers. Liaison Officer, E.C. of Nigeria, Adelphi, John Adam St, W.C.2. Documents fee £5, made payable to E.C. of Nigeria.

7 Sept.—Australia. Smoke density recording apparatus. Western Australian Tender Board, 74 Murray St, Perth. B.o.T. (ESB/23995/61).*

12 Sept.—Pakistan. 9 kV substations (excluding transformers) for Lyallpur, Mugaffargarh, Shadpur and Mainwali area. West Pakistan W.A.P.D.A., Lahore. B.o.T. (ESB/24013/61).*

12 Sept.—Trinidad. Metering equipment (10 items). Purchasing Officer, Electricity Commission, G.P.O. Box 121, Port of Spain. B.o.T. (ESB/23491/61).*

13 Sept.—Iraq. Lamps, wire, lamp holders, fuse boxes, adhesive tape, switches, plugs, sockets, conduit fittings, and screwdriver testers. Ministry of Defence, Directorate of Contracts and Purchases, Baghdad. B.o.T. (ESB/23444/61).*

15 Sept.—India. Tender HCP/SVHEP/1. 30 MVA synchronous condenser, starting switchgear and control panels for Bangalore Receiving Station. Details from Co-ordinating Branch, India Store Dept., Government Bldg, Bromyard Ave, W.3. Fee £3 15s. Viewing reference S.3323/61/NSC/ENG.2.

25 Oct.—Egypt. 220 kV transmission lines and transformer stations for interconnection of Cairo, Alexandria, Delta and Suez area power stations and to supply Ismailieh and Tahrir. Technical Bureau of the U.A.R. Electrification Projects, 56 Sharia Giza, Orman, Cairo. B.o.T. (ESB/23429/61).*

TRADE NOTES

Changes of Address. Cossor Radio and TV Ltd. have moved to 233 Tottenham Court Rd, W.C., but the telephone number remains Gerrard 2931. Birmingham Sales Office of Midland Silicones Ltd. is now at larger premises: Lichfield Hse, Smallbrook, Birmingham 5, under the managership of Mr J. J. Newland.

New Telephone Number. The telephone number of W. G. Pye and Co. Ltd. is now Cambridge 58866.

Southampton Branch. Astley Vulcan Finance Ltd. have opened a branch at 169-170 High St, Southampton.

Middlesbrough Warehouse. British Insulated Callender's Cables Ltd. have opened a new warehouse at Haverton Hill Rd, Stockton-on-Tees. This is subsidiary to the main stores and offices of the branch in Norton St, Middlesbrough.

New Company. Robt. D. W. Bowtle Ltd. is the title of a company recently formed to take over what was previously a purely personal business of engineering consultants and agents. Mr. Bowtle continues to operate the business.

Australian Customs Change. Under new by-laws, the Australian Dept of Customs and Excise announce that mercury and sodium discharge lamps, and automatic voltage regulators, are free of duty under the British Preferential Tariff.

Angola Agency Sought. Companhia Comercial Oriental, Lda., Caixa Postal (P.O. Box) 5566, Luanda, Angola, are interested in the sole agency for manufacturers and exporters of radio sets, portable transistors, electronic components, electron tubes and valves. Financial information obtainable from their bankers, Bauo Comercial de Angola, Luanda.

CONTRACTS PLACED

Air Ministry. Modification of airfield lighting/distribution systems at Kemble and Little Rissington, Glos, T. Clarke and Co. Ltd.

Belfast C.C. Electrical installation in Ballymurphy Primary School, James Moore.

Carlisle T.C. Provision of street lighting on Morton estate (stage 4), Cohen Bros., £2,020.

Croydon B.C. Rewiring of: Winterbourne Junior Boys', Girls' and Infants' schools, Reid and Barrow Ltd., £5,242 16s; Davidson Secondary Mixed and Infants' schools, J. P. Sheen, £3,720. Recommended.

Doncaster R.D.C. Provision of street lighting along Thorne Rd, Concrete Utilities Ltd., £1,970.

Doncaster T.C. Electrical work in 104 prefabricated bungalows, Broomhouse La estate, Balby, Yorkshire E.B., £1,040. Recommended.

East Anglian Hospitals. Fulbourn Hospital admission unit: electrical installation, Mann Egerton and Co. Ltd., £16,788; lift installation, Evans Lifts Ltd., £4,440. Recommended.

Gosport B.C. Wiring additions in 96 Millpond Rd houses, Bathbrite (Fareham) Ltd., £1,496. Recommended.

Llanelly R.D.C. Provision of sodium street lighting along A48, South Wales E.B., £1,292.

London C.C. Lift installations, Trafalgar/Raleigh secondary schools, Elliston Evans and Jackson (London) Ltd., £10,720.

Middlesex C.C. Supply and erection of 14 30 ft steel columns with 400 W mercury lighting/gear at Wraysbury roundabout, Staines By-pass, Abacus Municipal.

Newcastle upon Tyne C.C. Two ten-ton and one 40-ton crane, Cowans Sheldon and Co.; two six-ton cranes, Stothert and Pitt Ltd.—total cost £169,000. Provision of cathode ray direction finding equipment for Woolsington Airport, Ekco Electronics Ltd., £4,265 12s 2d.

Whitchurch P.C. Provision of new street lighting along seven roads, General Electric Co., £1,197 15s 3d.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

"Diamond H." 777,289. Class 9. Switches, sockets, relays, plugs and pilot light indicators, etc. "Diamond H" Switches Ltd., Gunnersbury Ave, W.4.

Duet. 808,111. Class 11. Space heaters. Aladdin Industries Ltd., Aladdin Bldgs, Western Ave, Greenford, Middx.

Elexso. 809,859. Class 9. Photoelectric and electronic sorting apparatus, etc. ESM Photoelektrische Maschinen Aktiengesellschaft, Aeschenvorstadt 24, Basle, Switzerland.

Eventherm. B815,461. Class 11. Heating apparatus, etc. Sterling Engineering Co. Ltd., Sterling Wks, Dagenham, Essex.

Gloria. 817,387. Class 11. Sewing machine lamps, etc. Ankerphoenix Nahmaschinen Aktiengesellschaft, Kleine Bahnhofstrasse 3, Bielefeld, Germany.

Polarad. 798,385. Class 9. Signal generators and analysing devices and power-measuring devices, etc. Polarad Electronics Corpn., 43-20 34th St, Long Island City 1, New York, U.S.A.

QA in design. 787,068. Class 1. Chemical substances, etc. for use in arc welding. 787,069. Class 7. Machines and generators, etc., for arc welding. 787,070. Class 9. Apparatus and electrodes, etc. for arc welding. Quasi-Arc Ltd., Bridgewater Hse, Cleveland Row, St. James's, S.W.1.

Valor. 819,103. Class 11. Appliances and apparatus, etc. The Valor Co. Ltd., Bromford, Erdington, Birmingham 24.

Vibrasorb. 817,397. Class 6 and 817,398. Class 7. Anti-vibration mountings and dampers, etc. Delaney Gallay Ltd., Vulcan Wks, Edgware Rd, Cricklewood, N.W.2.

Wandleslughitem. 818,215. Class 9. Covered wire, insulated cables and conduits. Wandleside Cable Wks Ltd., 106 Garratt La, Wandsworth, S.W.18.

BUSINESS PROSPECTS

Alton. John Laing (Construction) Ltd., Mill Hill, N.W.7, awarded £2½ million contract for new Harp Lager Brewery, Manor Pk. R.D.C. propose seven blocks of flats, Sutton Field, Whitehall; Engineer.

Amersham. J. Douglass Mathews and Ptnrs., 3 Ebury St, S.W.1, architects for proposed £100,000 UKAEA physics and general service laboratory.

Barnet. N.W. Metropolitan Regional Hospital Board, Eastbourne Terr, W.2, propose nurses' home, Barnet General Hospital; Board architect. Herts C.C. propose extentions to Queen Elizabeth Girls' Grammar School, costing £238,000; plan includes swimming bath.

Barnsley. Sheffield Regional Hospital Board propose new St. Helen Hospital to cost £5 million. Architects, Chas. B. Pearson, Son and Ptnrs., 18 Dalton Sq, Lancaster.

Basildon. Spong and Co. Ltd., Woodville Grove, N.15, propose new factory; architects: Fuller, Hall and Foulsham, 212 High Holborn, W.C.1.

Bathgate. Caledonian Property Co., Dundee, propose redevelopment of town centre, Blackburn, nr. Bathgate. Plans include hotel/public bldgs/46 shops and dwellings. Cost £500,000.

Belfast. W. H. Stephens and Sons, 13 Donegall Sq North, quantity surveyors for proposed extensions to Presbyterian War Memorial Hospital, Howard St. Electricity Committee propose £265,000 substation for oil refinery, Sydenham.

Birkenhead. C.C. propose £155,000 health and welfare departments, Hamilton Sq.

Blaydon. U.D.C. propose 20 dwellings, Rowlands Gill. Surveyor.

Boldon. Gordon Durham and Co. Ltd., bldrs, Moore La, East Boldon, propose private housing estate, Newcastle Rd.

Boston. Sheffield Regional Hospital Board, Old Fulwood Rd, Sheffield, appoint E. G. Phillips, Son and Ptnrs., Annesley Gr, Nottingham, consulting engineers for proposed mechanical services at new general hospital.

Bournemouth. B.C. propose six blocks of flats, Moore Ave. Architect.

Brighton. Planned: seven-storey offices, Regent Hill, by Hallmark Securities, 9 Wimpole St, W.1; and seven-storey offices, Preston Rd, for Factory and Commercial Hldgs Ltd., 36 Wigmore St, W.1.

Bristol. Schweppes Ltd., Connaught Pl, W.2, propose additional accommodation, Brislington trading estate. Modern Engineering (Bristol) Ltd., Emery Rd, propose expansion on same estate. A. F. French and Ptnrs., Pearl Assurance Hse, Queens Sq, architects for McKay Securities Ltd. £250,000 showrooms/offices.

Bromsgrove (Worcs). C.C. propose second stage of new teachers' training college, Bromsgrove, to cost £100,000.

Cardiff. Ocean Club, Whitaker Rd, propose £200,000 extensions. Architects, Osborne V. Webb and Ptnrs., 20 Dumfries Pl.

Cardigan Bay. Bishton Holdings Ltd., Bromsgrove, Birmingham, propose scheme for Bron-y-Mor holiday township with 1,000 dwellings and 12-storey hotel; cost between £3 million and £5 million.

Carlisle. C.C. propose new junior school, Morton. Architects, Johnson and Wright, 13 Castle St.

Chichester. Barclays Bank, London, E.C.3, award £110,000 contract for new offices to W. Llewellyn and Sons Ltd., Eastbourne.

Christchurch. Tuckton Investments Ltd. propose 72 flats, Stour Rd.

Coventry. Ignition and Electrical Services Ltd., 87 Little Park St, propose two-storey offices/workshops/warehouse, Bishop St.

Crawley. Westminster Bank Ltd., Lothbury, E.C.3, propose £300,000 offices. Contractors, Gilbert-Ash Ltd., 1 Stanhope Gate, W.1.

Crowborough. Horder Centres for Arthritics, Bishop Kings Rd, W.14, propose new centre at St. John's. Architect, H. E. Senkowski, 70 Blandford St, W.1.

Croydon. Prudential Assurance Co. Ltd., 142 Holborn Bars, E.C.1, propose showrooms/offices, Wellesley Rd. L.M. Estates Management Ltd., 35 North Audley St, W.1, propose offices, Dingwell Rd. Donald Rowsell and Ptnrs., 11 George St, architects for proposed 14-storey offices, Dingwell Rd.

Cumberland. C.C. propose new £170,000 school, Longtown.

Darlington. Gt. Universal Stores Ltd. propose three-storey shopping block, Northgate. Architects, North and Ptnrs., 40 Broadway, Maidenhead.

Doncaster. Abbey National Bldg Soc., Abbey Hse, Baker St, W.1, propose three-storey offices, Hall Gate. Northern Butchers Hide and Skin Co. Ltd., Friendly St, propose offices and slaughterhouse. Sheffield Regional Hospital Board, Old Fulwood Rd, Sheffield, propose developments at Tockhill Hospital. T.C. propose £1,040 electrical improvements to 104 prefab dwellings, Broomhouse La estate; Surveyor.

East Leake. J. Enness and Co. Ltd., East Leake, propose 100 dwellings, Rushcliffe estate.

Edinburgh. Michael Laird, 22 Moray Pl, architect for proposed £100,000 George Watson's Boys' College music school.

Enfield. Percy Bilton Ltd., 54 Uxbridge Rd, W.5, propose factory/offices, Bilton Way. Enfield Rolling Mills Ltd., Millmarsh La, propose new premises in same road.

Essex. C.C. propose £524,978 extensions to County Hall, Chelmsford.

Exmouth. Proposed: £120,000 swimming pool with dance hall on Imperial Recreation Ground. Surveyor.

Failsworth U.D.C. Tender: Robert Sidlow Public Library. Clerk, Oldham Rd, Failsworth.

Fife. Central Farmers Ltd., Aberhill Wks, Methil, Leven, propose factory, Halbeath; architects: L. A. Rolland and Son, Albion Hse, Shorhead, Leven.

Frome. R.D.C. propose 65 dwellings, Mount housing estate. Engineer.

Gateshead. Matmers Property Co. Ltd., 31a York Pl, Leeds, propose shops, High St.

Havant. Land and General Group, Berkeley Sq, W.1, propose residential development of seven acres.

Heanor. Canlin and Bowmer Ltd. propose extensions to Cromford Rd foundry.

Herts. C.C. propose £253,000 new secondary school, with youth wing, Pine Grove, Brookmans Pk.

Hornsey. B.C. propose installation of floodlighting at Bishop School playing area. Engineer.

Hounslow. LTE propose rebuilding Hounslow East station at cost of £100,000.

Isleworth. Gillette Industries Ltd. propose £600,000 reconstruction and extensions to Gt. West Rd factory; contractors: Kyle Stewart (Contractors) Ltd., Ardshiel Hse, Empire Way, Wembley Pk.

King's Lynn. R. G. Carter Ltd., Drayton, Norwich, contractor for proposed Campbell's Soups research centre, King's Lynn.

Leics. C.C. award £349,901 contract for 259 houses to John Laing (Construction) Ltd. Grosvenor Hse (Park La) Ltd., propose £2½ million hotel with ten shops and 20-storey offices, George St. C.C. propose £125,000 adult training centre and workshops, Aylestone Rd.

Lichfield (Staffs). C.C. propose £60,000 home for aged, Western By-pass.

London. Devereux and Davies, Gower St, W.C.1, architects for London Merchant Securities 21-storey offices on site of Century Hse, Westminster Bridge Rd, S.E.1. Consumers' Assen, 333 High Holborn, propose new headquarters, South Bank. Moriet and Wood, 181 Queen Victoria St, E.C.4, propose flats/exhibition bldg, South Bank. New bldgs, Portland Pl, proposed by Fitzroy Robinson and Ptnrs., 3 Grays' Inn Sq, W.C.1. Nicholson Construction Co. Ltd., 133 Ebury St, S.W.1, propose flats/offices, Southampton Row, Russell Sq. 22-storey offices, Victoria St/The Broadway, proposed by Westminster Trust Ltd., 28 Victoria St.

Manchester. Jones, Lang, Wootton and Sons, surveyors, 16 King St, E.C.2, propose showrooms/offices, Bombay Hse, Whitworth St.

Mansfield. Seal and Turner Ltd., Sylvester St, propose extensions to factory.

Middlesbrough. Kitching and Co., 21 Albert Rd, architects for Greco Bros. Ltd. proposed new factory, Lloyd St/Florence St. T.C. propose 33 dwellings, Easterside; contractor, Emco Ltd., North Ormesby.

Milford-on-Sea. Rookcliffe Properties Ltd. propose 125 flats, Rookcliffe nursery site.

Minehead. Butlins Ltd. propose £3 million holiday camp to be built by Butlins Construction Co. Ltd., 439 Oxford St, W.1.

Newcastle. R. Turley and Assets, 46 Jesmond Rd, architects for proposed Slatyford La secondary school. C.C. propose £233,000 development, Fawdon. Scheme includes 72 dwellings, three stores and six shops; architects: Waring and Netts, Lansdowne Terr, Gosforth.

North Riding. C.C. propose Ings Farm and Cotherstone County schools; and three small schools, Nawton, West Tanfield and Topcliffe. Co. Architect, Northallerton.

Northumberland. C.C. propose £246,000 Gosforth Grammar School and £214,000 Lamington Claremont Secondary School. Co. Architect, North Rd, Newcastle.

Oban. Royal National Mission to Deep Sea Fishermen, 43 Nottingham Pl, W.1, propose new institute. Architect, Leonard F. Ivall, 4 Seafield St, Cullen.

Petersfield. R.D.C. propose 20 dwellings, Tower Rd estate, Liphook. Engineer, Old College, Petersfield.

Plymouth. Mugridge and Anderson, Corporation Rd, contractors for proposed Hurley (Marine) Ltd. new factory.

Port Talbot. B.C. propose £277,000 swimming pool, Aberavon. Engineer.

Prestwick. Ministry of Aviation propose £750,000 hotel, Prestwick Airport.

Richmond. B.C. propose £250,000 public baths in Old Deer Pk.

Rochdale. Modern factory proposed by Robert Riley (Hldgs) Ltd., Milkstone Spring Wks, More La.

Romsey and Stockbridge. R.D.C. propose four pumping stations and sewage disposal works, Stockbridge.

Rotherham. Husband and Co., 388 Glossop Rd, Sheffield, architects for proposed G. L. Willan Ltd. 12-acre factory, Catcliffe. Planned: chemical plant bldgs, Bawtry Rd, Brinsworth, for British Oxygen Co. Ltd.

Rutland C.C. Second stage of Uppingham Primary School proposed for autumn; County Surveyor, Oakham. New primary school, Edithweston, proposed; Co. Surveyor.

Salisbury. Hammerson Group, Quadrex Hse, Park La, W.1, propose shopping centre development, New Canal/New St/High St. Architect, Wallace Smith, 84 Crane St.

Scarborough. F. Shepherd and Co. Ltd., Blue Bridge La, York, contractors for D. H. Greaves Ltd. factory, Cayton Rd, Eastfield.

Southampton. Wessex Regional Hospital Board, Winchester, propose additional wing for 40 patients at Tatchbury Mount.

Southport C.B.C. Tender: 56 houses, traditional style, Staveley Rd, Ainsdale. Architect.

South Shields. John Cummings Ltd., Matambe Terr, Sunderland, contractors for 30,000 sq ft extensions to Fry's Die Castings Ltd. factory, Bede trading estate.

Spalding. Sheffield Regional Hospital Board propose chronic sick unit, Johnson Hospital. Consulting engineers, F. P. Luckett and Ptnrs., 89 Lewisham High St, S.E.13.

Stanmore. Planned: extensions to Royal National Orthopaedic Hospital. Quantity surveyors, L. A. Francis and Sons, Vernon Hse, Sicilian Ave, W.C.1.

Stevenage. Laboratory/offices, proposed by Roussell Laboratories Ltd., Harrow Rd, N.W.10; architects: J. D. Morgan and D. C. Branch, 8 Gt. New St, E.C.4.

Stretford. Planned: factory extensions, Christie Rd, for E. Boydell and Co. Ltd.

Business Prospects—continued

Truro. Adams, Holden and Pearson, 38 Gordon Sq, W.C.1, architects for proposed new hospital, Trenslake.

Wallsend. Bovis Ltd., Stanhope St, W.1, contractors for further factory extensions for Geo. Angus and Co. Ltd.

Wembley. Johnson, Matthey and Co. Ltd. award £100,000 contract for new factory to Haymills (Contractors) Ltd., Hanger Green, Ealing, W.5.

West Hartlepool. T.C. propose 44 dwellings, Rift Hse, and 29 in central area. Architect.

West Sussex C.C. Old people's homes, Crawley and Horsham; £85,363. Contractors, Hassocks Properties Development Co. Ltd., Haywards Heath. (Recommended).

Yorks. Reema Ltd. awarded contract for new open-air swimming pool, Stainforth.

New lighting schemes

Corbridge P.C. (Northumberland). Street lighting conversion from gas approved.

Market Rasen U.D.C. £5,000 street lighting improvement scheme proposed.

Southport. Seven town centre streets to be equipped with linear sodium lighting on 30 ft columns.

Sandy U.D.C. 53 additional lighting units and conversion of main streets to mercury at cost of £3,000 approved by Lighting Committee.

Alton U.D.C. Amended lighting scheme involving 112 18 ft steel columns and 32 brackets at estimated cost of £7,508 recommended for approval.

Gazette Announcements

COMPANIES ACTS

F. E. White (Electrical) Ltd. Meeting of creditors to be held at 4 New St, Leicester, on 11 Aug., at 11.30 a.m.

Midland Lighting and Bldg Ltd., 167 London Rd, Leicester. Winding-up order dated 26 June.

Brown Bros. (Electrical) Ltd. Meetings of members and creditors to be held at Brotherton Chmbrs, Westgate, Leeds 1, on 28 Aug., at 10 and 10.30 a.m., respectively, for the purpose of receiving an account of the winding-up.

Phipps and Culling (Products) Ltd. First meetings of creditors and contributories to be held at Inveresk Hse, 346 Strand, W.C.2, on 8 Aug., at 11.30 a.m. and 12 noon, respectively.

Mills Electrical Service Ltd. and **W.E.A. Lectric Ltd.** Creditors to send details to liquidator, G. A. Wale, Walter Hse, 418-422 Strand, W.C.2, by 7 Sept.

Companies Winding-up

R. Brbck Ltd., 135 Brockhurst Rd, Gosport, Hants, electrical engineers. The statement of affairs listed preferential debts of £505, debentures for £44,809 and unsecured liabilities of £24,358. Assets were valued at £17,113. Subsequent realisations up to 8 July totalled £8,731, of which £3,631 had been distributed. Sale of the television rental business was expected to produce £13,000 which was specifically pledged to finance companies, the set owners. Remaining assets were expected to realise £4,489.

The company was formed in 1959 with an issued capital of £200, and the business carried on from various addresses in the Portsmouth, Gosport and Fareham areas.

Creditors left the case with the Official Receiver as liquidator.

Lee Domestic Appliances Ltd., 47 Deptford Broadway, S.E.8, domestic electrical appliances dealers.

Information in the hands of Official Receiver showed liabilities of £10,000 with additional contingent liabilities to finance companies of £15,000. Assets comprised about £4,000 due from customers who had already defaulted on their hire purchase payments, £8 for furniture and £40 cash.

The company was formed in February, 1960, and has an issued capital of £1,000. The directors throughout had been Mr J. Fawcett and his mother. The case was left with the Official Receiver as liquidator.

Partnership Dissolved

Canterbury. Partnership between E. Levitt and H. A. Macdonald, radio, television and electrical engineers, carrying on business as Aylesham Electric Co., at 26 Queen St, Deal, and 62 Cornwallis Ave, Aylesham, dissolved as from 18 Jan.

BANKRUPTCY ACTS

First Meetings and Public Examinations

Rochester. C. W. Boulton and I. G. Payne, domestic appliance retailers, formerly carrying on business in partnership as P. and B. Electrical Appliance Co. at 19 High St, Sheerness. First meetings: 10.30 a.m. for C. W. Boulton and 11 a.m. for I. G. Payne, on 9 Aug., both at Official Receiver's Office, 40 St. Margaret's St, Rochester; and public examinations: 10.30 a.m. 21 Sept., at Court Hse, Eastgate, Rochester.

Brighton. P. E. Gale, electrical contractor and retailer, formerly carrying on business at The Shop, Bosham La, Old Bosham. First meeting: 11 a.m., 4 Aug., at Official Receiver's Office, 8 Old Steine, Brighton 1: and public examination: 10.30 a.m., 29 Sept., at Court Hse, Church St, Brighton 1.

Leeds. S. C. Aspell, appliance wholesaler, formerly carrying on business as A. and A. Supplies (Leeds), at 1-3 Cambridge Rd, Leeds 7. Public examination: 10.30 a.m., 17 Oct., at County Court Hse, Albion Pl, Leeds 1.

Leicester. A. Taylor, electrical engineer, formerly carrying on business at 2 Havelock St, and 26a Asylum St, and 42 Highcross St. Public examination: 10.30 a.m., 29 Sept., at The Castle, Leicester.

Nottingham. H. E. Turner, radio, television and electrical engineer, formerly carrying on business at 26 Outram St, Sutton-in-Ashfield. Public examination: 10 a.m., 5 Oct., at Court Hse, St. Peter's Gate, Nottingham.

Appointments of Trustees

Bradford. W. D. Edmonds, domestic appliance retailer, formerly carrying on business at 1 Kipping La. Mr. G. E. Rushton, 36 North Parade, Bradford 1, appointed trustee as from 14 July.

Liverpool. J. E. Oultram, electrical contractor, formerly carrying on business at 9 and 55 Mersey Rd, Widnes. Mr. R. A. Hawken, Bank Chmbrs, 1 John St, Bedford Row, W.C.1, appointed trustee as from 20 July.

Yeovil. H. J. Harvey, cycle and electrical dealer, formerly carrying on business at Kingsbury-Episcopi. Mr P. W. Hort, 28 Baldwin St, Bristol 1, appointed trustee as from 21 July.

Intended Dividend

Newcastle upon Tyne. W. Bell, radio/television dealer and electrical contractor, formerly carrying on business as Heaton Electronics at 61 Headlam St, Byker. Last day for receiving proofs for intended dividend: 9 Aug., by trustee: W. Armstrong, Clarendon Hse, Clayton St West, Newcastle.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Derek R. Adams Ltd., 3-5 Queensway, Hemel Hempstead, Herts. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: Derek R. Adams and Nina L. Adams.

Amalgamated Electric Services Ltd. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Philips Electrical Industries Ltd., Century Hse, Shaftesbury Ave, W.C.2, and Richard A. P. Burrill.

Automatronic Ltd., 76 Shepherds Bush Rd, W.6. To manufacture, sell or rent, service and supply parts for any electronic, electrical or mechanical device, etc. Nom. cap.: £100. Dirs.: Hector Dinnie and Lionel A. Harding.

Bacel Ltd., 3 Handsworth Cres, Sheffield 9. To carry on the business of electrical engineers, etc. Nom. cap.: £100. Dirs.: Gordon Nadin and Vera Nadin, Alfred Watts and Margaret Watts.

Carbon Electric Holdings Ltd., 21 Copthall Ave, E.C.2. To carry on the business of an investment trust company; Power is taken to carry on the business of manufacturers of and dealers in electrical apparatus, carbon brushes, carbon, brush holders, etc. Nom. cap.: £21,000. Dirs.: not named. Subs.: John E. Norton and C. J. A. Dixon.

Chamberlain Electrical Installations Ltd., 215 High St, Hounslow. Nom. cap.: £1,000. Dirs.: Wm. Chamberlain and Jeffrey W. Chamberlain.

Electrical Installation (Cambridge) Ltd., 52 George St, Cambridge. Nom. cap.: £1,000. Dirs.: Bernard S. Baldry and Richard H. Ransome.

Thomas, Hargreaves and Co. Ltd., 89-91 Newman St, W.1. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £100. Dirs.: Ronald C. Thomas and Robert Hargreaves.

Hermann Electrical Ltd., 37 Inglis Rd, W.5. Nom. cap.: £100. Dirs.: Rudolf Hermann and Elizabeth Rahmann.

Horne Electrical (Appliances) Ltd., 48 Windmill St, Gravesend. Nom. cap.: £100. Dir.: Kenneth A. Horne.

I.E.C. (Electronics) Ltd. Nom. cap.: £5,000. Dirs.: Robert A. Saville-Sneath and Monica E. Saville-Sneath, Balcombe Hse, Branksome Park, Poole, Dorset.

Janplace Ltd. Electrical engineers, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and Thos. A. Herbert, 156 Strand, W.C.2.

Medina Electrical Installations Ltd., Godshill Post Office, Godshill, Ventnor, I.W. To take over business of electrical engineers carried on as "Medina Electrical Installations" at Godshill, Ventnor, I.W., etc. Nom. cap.: £1,000. Permt. dirs.: Grenville Haydon and Raymond G. Fellows.

Norber (Electrical) Ltd., 62-4 Temple Chambers, Temple Ave, E.C.4. Dealers in electrical and other fittings, etc. Nom. cap.: £100. Dirs.: Norman L. Ginsberg and Beryl Ginsberg.

Northern Electrical Service Co. (London) Ltd. Nom. cap.: £2,000. Dirs.: not named. Subs.: John D. Martin. 19 Eversley Cres, N.21, and Michael J. Culleton.

Parmida Electrics Ltd., 713 Imperial Hse, Kingsway, W.C.2. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Shirley Hart and Averill Hart.

Chas. E. Price Ltd., 28 Market St, Hoylake, Ches. To carry on the business of electrical and refrigeration engineers, etc. Nom. cap.: £10,000. Dirs.: Charles E. Price and Muriel Price.

Raff Radio Ltd., 35 Bow Rd, E.3. To take over the business of a radio and electrical engineer carried on at 67-9 Stafford Rd, Wallington, Surrey, by P. Chlapik, etc. Nom. cap.: £800. Dirs.: Pavel Chlapik and Mrs. Olive M. Chlapik.

Start Electro Ltd., 6 Surrey St, W.C.2. Manufacturers of and dealers in all kinds of tools, electrical goods, etc. Nom. cap.: £2,000. Dirs.: to be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

A. J. Sumner Ltd., 70 Kennel Ride, Ascot, Berks. To carry on the business of electrical engineers, etc. Nom. cap.: £4,000. Dirs.: Albert J. Sumner and Joan M. Sumner.

Warecrete Electrics Ltd., Crane Mead Wks, London Rd, Ware, Herts. To carry on business of electrical engineers, etc. Nom. cap.: £100. Dirs.: David D. Render, Horace W. Almeroth and Arthur F. Flay.

KEEPALITE

PACKS MORE IN THE SAME SPACE

Keepalite, the Chloride Company's automatic emergency lighting system, is now equipped exclusively with the new Chloride Planté cell which occupies only half the space previously needed by cells of the Planté type of equivalent capacity. Keepalite thus adds this important advantage to the many virtues that have made it the most trusted and widely used emergency lighting system in Great Britain. Despite its small size and light weight, the new cell is extremely robust and has all the great length of life associated with the Planté type of construction. As always, the advisory service of the Company's electrical engineers is at the call of electrical contractors and engineers who are interested in emergency lighting installation.

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CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

THE URBAN DISTRICT COUNCIL OF HOYLAKE
Conversion of Group "A" Lighting to Sodium Type Lanterns
Supply of Equipment

TENDERS are invited for the supply and delivery of 208 No. Lanterns with 140 W integral sodium lamps and also auxiliary equipment for mounting in the base of existing 25 ft steel columns.

Specification and forms of tender can be obtained from the Council's Engineer and Surveyor, 8 Riversdale Road. West Kirby, Wirral, and are to be returned to the undersigned not later than noon on Thursday, 24 Aug., 1961.

FRANK BARNES,
25 July, 1961. Clerk of the Council.
(B 520)

NORTH RIDING OF YORKSHIRE COUNTY COUNCIL
Highways and Bridges Department
Mercury Vapour Lighting at 2 Roundabouts

TENDERS invited: apply for specification, etc.. to the County Surveyor, County Hall, Northallerton, Yorkshire. The closing date for tenders is 21 Aug., 1961.

R. A. WOTHERSPOON,
Clerk of the County Council.
County Hall,
Northallerton. (B 510)

CITY OF BELFAST

TENDERS are invited for the supply, delivery and erection of:—
33 kV Switchgear, including modifications to existing equipment

Form of Tender and Specification (No. W.198) in duplicate may be obtained at the Electricity Department, East Bridge St, Belfast 1, on payment of a deposit of 2 gn, which amount will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the tender documents may be obtained at 1 gn each, which sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each Tender (one copy only) in sealed envelope marked "Tender for 33 kV Switchgear, etc.—Electricity Committee" and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 1 Sept., 1961.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any Tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.
City Hall,
Belfast 1,
P.O. Box 234. (B 536)

APPOINTMENTS VACANT

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
No. 4 Sub-Area
SUB-AREA ENGINEER

REQUIRED in the Board's No. 4 Sub-Area based on Wrexham. The Sub-Area covers approximately 4,000 square miles, comprising the counties of Anglesey, Caernarvon, Denbigh, Flint, Merioneth and

continued in next column

continued from previous column

Montgomery and parts of the counties of Cardigan, Cheshire and Shropshire, and is divided into eight districts under District Managers.

The area is predominantly rural, but includes some large industrial supplies.

Salary in accordance with Scale N.J.M. 5, i.e., £2,595/£2,815 per annum.

Applicants should have appropriate technical qualifications, experience of the design, construction, operation and maintenance of a large distribution system up to and including 33 kV, and the ability to direct the staff associated therewith.

Applications should be marked "Personal" and submitted to the Secretary at Board Headquarters, Electricity Hse, Love La, Liverpool 3, so as to be received not later than 26 Aug., 1961. (B 541)

AIR MINISTRY

REQUIRE Main Grade and Basic Grade
MECHANICAL AND
ELECTRICAL ENGINEERS

for design, construction and maintenance of installations on (a) airfields, radar stations, missile bases, workshops and maintenance units for the R.A.F. at home and overseas; and (b) certain Civil Airports.

SALARY according to age, quals. and exp., ranges for Main Grade Engineers from £1,456/£1,950 (max.) and for Basic Grade from £936 (at 25) to £1,430 (max.), with an increase for London and slight decrease in country districts. In addition, basic grade salary is increased by £95 p.a. (within the maximum of the scale) after two years' approved service, subject to being corporate member of Institution of Mechanical or Electrical Engineers. Appointments long term with good prospects of pension and advancement to numerous posts in higher grades, viz.:

Main Grade Mechanical and Electrical Engineers, £1,456/£1,950—125 posts;

Senior Mechanical and Electrical Engineers, £2,080/£2,392—34 posts;

Superintending Mechanical and Electrical Engineers, £2,650 upwards—9 posts.

Vacancies occurring in these higher grades are, as a rule, filled by promotion of existing staff.

Good opportunities for acquiring experience overseas, where special allowances ranging at present up to £1,800 p.a. according to location and marital status, are payable in addition to a higher salary. Five-day week with four weeks' two days' paid leave p.a. initially.

QUALS.: (a) Graduate (for Basic Grade) or corporate (for Main Grade) membership of I.E.E. or I.Mech.E. (with appreciable electrical engineering experience) with at least three years' apprenticeship; or

(b) University degree (honours for Main Grade) or equivalent diploma in electrical and/or mechanical engineering with at least two years' apprenticeship.

In addition, all candidates should have been employed for minimum of two years with well established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects and, for basic grade posts, between ages 25 and 35. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D.128/1A. Selection will be by interview in London and certain expenses will be reimbursed. (B 428)

NEW ZEALAND
Navy Department

APPLICATIONS are invited for the undermentioned vacancy:

TECHNICIAN (ELECTRICAL)
H.M.N.Z. DOCKYARD, AUCKLAND
Vacancy No. 2060.

Salary: General Division: up to £856 or £900/£940.

Position is in Fire-Control Section and applicants should be experienced in electronic weapon control computers, remote control systems and data transmission equipment. Ordinary National Certificate an advantage.

Passages: Steamer fares of up to £172 each for the appointee and his wife, and pro rata for dependent children will be paid.

Incidental expenses: Up to £35 for a single person and £100 for a married man can be claimed to cover the cost of taking personal effects to New Zealand.

Application forms and further details are available from the High Commissioner for New Zealand, 415 Strand, London, W.C.2, with whom applications will close on 1 Sept., 1961.

Please quote reference B11/31/3 when inquiring. (B 511)

DEPARTMENT OF GOVERNMENT ELECTRICAL UNDERTAKINGS - CEYLON

POST OF ASSISTANT MECHANICAL ENGINEER
HYDRO-ELECTRIC SCHEME, STAGE IIB

APPLICATIONS are invited for one post of Assistant Mechanical Engineer (Temporary) in the Department of Government Electrical Undertakings for work in connection with the above scheme. The appointment will be for a period of two years.

The salary of the post is £2,000/£2,500 per annum according to experience of the candidate selected which will be paid at the current rate of exchange.

The successful applicant will be required to furnish a medical certificate as to his physical fitness for service in Ceylon.

Applicants must be Corporate Members of the Institution of Mechanical Engineers with experience on boilers and steam turbines, and must possess at least seven years' engineering experience.

The Ceylon Government will contribute 7½% of salary to a Provident Fund. Free passages to the Island and back will be provided for the successful applicant and his family up to a maximum of four persons besides the applicant. Rent allowances, if not in occupation of Government quarters and cost of living allowances are payable in terms of Government regulations in force at the time.

A specimen copy of the letter of appointment could be inspected at the office of the Ceylon Government Representative.

Applications giving full details of experience should be submitted in triplicate with three copies of testimonials to the Consulting Engineers, Messrs. Preece, Cardew and Rider, 8, 10 and 12 Queen Anne's Gate, Westminster, London, S.W.1. Applications should be submitted within two weeks of the appearance of this advertisement. (B 515)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(SUBSTATION MAINTENANCE)
(Z.1364)

PORTSMOUTH District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class J, Grade 7 (£1,275/£1,410 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance of plant and equipment at outdoor and indoor Substations on both urban and rural systems. Candidates should have had a good technical training, experience of the testing and maintenance of plant and equipment and should possess suitable technical qualifications. The appointment will involve standby duties.

DEMONSTRATOR
(Z.1385)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.C. Grade 1 (£600 x £25—£700 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications for both appointments on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting the appropriate "Z" number, not later than 14 Aug., 1961.

FITTER (ELECTRICAL)

Salisbury District of No. 4 (Bournemouth) Sub-Area. Rate of pay in accordance with Schedule "A" of the N.J.I.C. Agreement, at present 66·75d per hour, with N.J.I.C. conditions of service.

Experience in the work of fitting, erecting and maintenance of high voltage O.C.B.'s, isolators, transformers, switchgear and associated equipment is required.

Applications on forms obtainable from the District Manager, 17 New Canal, Salisbury, Wilts, and returned to him, quoting Z.1386, not later than 14 Aug., 1961. (B 534)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

THIRD ASSISTANT ENGINEER
OPERATIONAL RESEARCH SECTION
DIVISIONAL HEADQUARTERS
Vacancy No. 177/61.

APPLICATIONS are invited for the position of Third Assistant Engineer in the Operational Research Section, Divisional Headquarters, Nottingham.

Applicants should be suitably qualified in engineering or an allied science and have been in a position of some responsibility. The position calls for original thinking and the ability to apply new techniques to problems affecting the efficient utilisation of available resources.

The work is generally of an engineering nature but non-engineering studies are also undertaken.

Previous experience of Operational Research is not essential.

Commencing salary according to qualifications and experience within Class CX, Grade 8 (£1,165/£1,500 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 18 Aug., 1961.

This appointment is pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Administrative Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box No. 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Assistant Regional Director.
(B 537)

THE NORTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER
OLDHAM DISTRICT

DUTIES include assisting with the operation, maintenance and construction of the distribution system, both underground and overhead, up to 33 kV, including substations. The successful candidate will be required to undertake standby duties.

Salary Scale: £1,040/£1,165 p.a., Grade H.9. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, and returned to him by 14 Aug., 1961. (B 532)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate Vacancy No.

Derby and Burton Sub-Area

FOURTH ASSISTANT
DISTRICT COMMERCIAL ENGINEER
BURTON DISTRICT
Vacancy No. 90/61.

Salary: N.J.B. Class G, Grade 12, £765/£870 per onnum.

Duties will include assisting in the negotiations for the supply of electricity to agricultural. commercial, domestic and industrial consumers and the changeover of consumers' apparatus to standard voltage.

The successful candidate will also be required to supervise installation work and to advise consumers on tariffs, electrical installations and appliances, sales activities and general consumer service.

Applicants should preferably have received an engineering training and should have a good knowledge of the Board's tariffs, the I.E.E. Regulations and modern installation practice.

Ability to drive a car would be an advantage.

Applications stating age, qualifications and experience, previous and present appointments should be forwarded to the Manager, Derby and Burton Sub-Area, Electricity Offices, Irongate, Derby, in a confidential envelope endorsed "Fourth Assistant District Commercial Engineer—Burton," by 18 Aug., 1961.

Area Board Headquarters

FOURTH ASSISTANT ENGINEER
(TECHNICAL)
Vacancy No. 91/61.

Salary: N.J.B. Class BX, Grade 10, £935/£1,245 per annum, or Class BX, Grade 9, £1,005/£1,325 per annum, depending on the experience and qualifications of the successful candidate.

The duties of the post include assisting in the analysis and preparation of reports on the performance of the system and items of plant, and tests on various types of equipment.

Applications stating age, qualifications, education, experience, present and previous positions and salaries, should be addressed to the Chief Engineer, The East Midlands Electricity Board, Mapperley Hall, Nottingham, by 18 Aug., 1961. (B 486)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

North Caledonia Area

APPLICATIONS are invited for the superannuated post of

FOURTH ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)

for duty with a maintenance squad at Strichen, Aberdeenshire. Experience in the construction and maintenance of overhead lines and/or substations is desirable. Technical qualifications an advantage.

Salary and conditions in accordance with the N.J.B. Schedule, Class H, Grade 13 (Scale 4) £765/£870.

Application form obtainable from the Area Manager, West Villa, South St, Elgin, should be returned by 21 Aug., 1961, quoting Vacancy No. 61/13. (B 528)

CITY OF SALISBURY, SOUTHERN RHODESIA

VACANCY FOR SENIOR ELECTRICAL ENGINEER

SALARY Scale £1,768 2s 6d x £51 5s—£1,921 17s 6d per annum.

Applications are invited for the position of a Senior Electrical Engineer on the salary scale £1,768 2s 6d x £51 5s—£1,921 17s 6d per annum, commencing salary at the minimum of the grade. No allowances are payable.

Candidates should possess a degree in Electrical Engineering or the equivalent, and/or be Corporate Member of the British Institution of Electrical Engineers, and have at least 15 years' experience in the design, erection and maintenance of indoor and outdoor substations, transformers, switchgear, protection, etc., up to and including 33,000 V. Experience on 88 and/or 132 kV equipment will be an advantage.

The selected candidate will be deputy and assistant to the Engineer in charge of the substation section of the Distribution Branch of an undertaking covering approximately 600 square miles and some 1,200 substations, with a present system maximum demand of 120 MW, but may be assigned to such other duties as requisite in the Distribution Section. Experience in general distribution work, and in the control of staff in an organisation of similar size, is essential.

GENERAL:

The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund.

Candidates must submit full particulars of their qualifications, training and experience giving details of positions held and salaries received. Age, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs Merz and McLellan, Carliol Hse, Newcastle upon Tyne 1, to whom applications must be submitted on or before 18 Aug., 1961. (B 488)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

GRAVESEND POWER STATION
SHIFT CHARGE ENGINEER
Vacancy No. 205/61.

MANUAL staff will be considered for this vacancy and training may be given.

Salary: N.J.B. Class C, Grade 7, £965/£1,084 per annum including London and Shift Allowances.

Applications giving age, details of experience, etc., should be sent to the Station Superintendent, Suffolk Rd, Gravesend, Kent, to arrive by 10 Aug. (B 544)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Hams Hall "C" Power Station, Lea Marston, Sutton Coldfield. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade K8, £1,275/£1,410 per annum, plus 10% for shift duties.

Applicants should have received a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear, and a knowledge of P.F. firing is desirable. Appropriate technical qualifications would be an advantage.

Apply, quoting Vacancy No. 203/61MD on Form AE6, available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warwickshire, by 18 Aug., 1961. (B 531)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Board's No. 3 Sub-Area:—

FOURTH ASSISTANT ENGINEER (TECHNICAL)

at No. 3 Sub-Area Headquarters, Chester. Salary: £890/£1,015 per annum (N.J.B. K/13).

Applicants should have received an engineering training, and possess suitable technical qualifications. Duties will include testing and commissioning electrical plant and ancillary equipment, at voltages up to 33 kV.

SECTION ENGINEER

in the Chester District. Salary: £1,275/£1,410 per annum (N.J.B. J/7).

Applicants should have had experience in the construction and operation of overhead and underground distribution systems up to 33 kV, including indoor and outdoor substation equipment, and be in possession of suitable technical qualifications.

Appointments subject to medical examination. Pension Scheme.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity Hse, Newgate St, Chester, must be forwarded not later than 18 Aug., 1961. (B 540)

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

Vacancy Notice No. ET/AV/74/61.
ASSISTANT STATION CHEMIST
HAYLE POWER STATION

APPLICATIONS are invited for the above appointment. Possession of H.N.C. in Chemistry or equivalent, together with some Power Station experience would be desirable.

Salary N.J.B. Class F, Grade 10, Scale 5, £825/£940 per annum. Superannuation Scheme.

Vacancy Notice No. ET/AV/75/61.
GENERAL ASSISTANT ENGINEER
PORTISHEAD "B" POWER STATION

Possession of, or at present studying for a Higher National Certificate or similar qualification, would be an advantage.

Previous applicants need not re-apply.

Salary N.J.B. Class K, Grade 15, Scale 4, £765/£870 per annum. Superannuation Scheme.

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 21 Aug., 1961. (B 539)

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN
CROYDON AND PURLEY DISTRICT

SALARY: £740 x £25—£815 per annum including London Allowance under N.J.C. Grade 2. Superannuable. Applicants should have a good general education, experience in a distribution drawing office and be fully conversant with mains recording and preparation of system diagrams, etc.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 16 Aug., 1961.

SHOWROOM ASSISTANT
CROYDON AND PURLEY DISTRICT

Annual salary including London Allowance £285 at 16 to £490 at 21 rising to £600, £680 or £740 according to qualifications obtained and ability. Duties will include general showroom work, and the advising of consumers on the use of electrical apparatus. The appointment is primarily for the Croydon showroom, but the successful applicant may be required to work occasionally in any showroom of the Croydon and Purley district. He may also be required to carry out cashier duties.

Applications quoting ET and naming two referees on forms from District Manager, Seeboard, Electric Hse, Wellesley Rd, Croydon, by 16 Aug., 1961.

GEORGE WRAY,
Secretary.
(B 533)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region
East Midlands Division

SHIFT CHARGE ENGINEER
SPONDON POWER STATION
Vacancy No. 173/61.

APPLICATIONS are invited for the position of Shift Charge Engineer at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Applicants should have had a sound training and considerable experience in a modern Generating Station.

Preference will be given to candidates who are Graduate Members of the Institution of Electrical or Mechanical Engineers, or who hold similar qualifications.

Salary will be within Class J, Grade 6 (£1,350/£1,500 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 11 Aug., 1961.

SHIFT CONTROL ENGINEERS
NOTTINGHAM POWER STATION
Vacancy No. 174/61.

Applications are invited for the positions of Shift Control Engineers at Nottingham Power Station, Queens Drive, Nottingham.

Applicants should have had a sound training and practical experience in a modern Power Station. Possession of Higher National Certificate, or equivalent, will be an advantage.

Salary will be in accordance with Class K, Grade 10 (£1,115/£1,245 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 11 Aug., 1961.

These appointments are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned and returned to him by the specified date.

O. S. WOODS,
Assistant Regional Director.
(B 538)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

THIRD ASSISTANT ENGINEER
(DISTRIBUTION DESIGN)

APPLICANTS should have had experience in the design of Underground and Overhead Distribution systems operating at voltages up to 66 kV in large industrial, urban and rural areas. Experience in substation design and construction will be advantageous.

Salary: N.J.B. Class N, Grade 10 (Scale 12): £1,350/£1,500 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield 1, not later than 18 Aug., 1961. (B 530)

UGANDA GOVERNMENT

Public Works Department

INSPECTOR OF WORKS (ELECTRICAL)

REQUIRED. Appointment on contract for one tour of 21-36 months in first instance. Salary according to age and experience in scale including Inducement Pay) rising to £1,671 a year. Gratuity 25% of total salary drawn. Outfit allowance £30 payable. Free passages. Liberal leave on full salary.

Candidates should be 29-40 years of age, and it is essential that they possess O.N.C. (Electrical) or equivalent qualification. They should also have served a full apprenticeship and had subsequent experience in maintenance of industrial electrical equipment and large installations. They must be fully conversant with U.K. Home Office Electricity Rules, Electricity Regulations under the Factories Act and those of the Electrical Commissioners.

Apply to Crown Agents, 4 Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/50987/EE. (B 521)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 244/ET/61.

APPLICATIONS are invited for the superannuable N.J.B. appointment of

SHIFT CHARGE ENGINEER

at Uskmouth "A" Power Station, West Nash, nr. Newport, Mon.

Salary: Schedule A, Class K, Grade 6, Scale 13, £1,440/£1,610 per annum plus 10% shift allowance.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

Special application forms obtainable from Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 19 Aug., 1961. (B 545)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

THIRD ASSISTANT DISTRICT ENGINEER
(AYR DISTRICT)

APPLICATIONS are invited for the above post from persons possessing a Higher National Certificate in electrical engineering and having experience in the maintenance and operation of overhead and uunderground systems up to 33 kV, load flow diagrams, voltage drop, short-circuit calculations and H.V. fault location.

The salary for the post, which is superannuable, will be in accordance with the N.J.B. Agreement, Class F, Grade 9, £890/£1,015 per annum.

Applications on the standard form should be submitted to Mr G. F. Moore, Manager, Greenholm St, Kilmarnock, not later than 11 Aug., 1961. (B 523)

GLAMORGAN COUNTY COUNCIL

INVITE applications from persons experienced in the design and progress of electrical installation schemes in public buildings for the permanent appointment of an

ELECTRICAL ENGINEERING ASSISTANT

(£960/£1,140 p.a.) in the Architect's Department. The commencing salary may be above the minimum of this grade.

The qualifications for the post should be a Higher National Certificate or an equivalent qualification, but suitably experienced technical officers who do not possess such qualifications may also be considered.

Applications giving details of age, training, qualifications and experience, together with the names of two referees, to be forwarded to the County Architect, County Hall, Cardiff, by 14 Aug., 1961.

RICHARD JOHN.
Clerk of the County Council.
(B 524)

THE NORTH WESTERN ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER
SUB-AREA ENGINEERING DEPARTMENT
PRESTON

APPLICANTS must have had a sound training in the planning, design and construction of all types of overhead and underground systems and substation plant.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale: £1,190/£1,325 p.a., Grade L.10. N.J.B. Conditions.

FOURTH ASSISTANT ENGINEER
SUB-AREA ENGINEERING DEPARTMENT
PRESTON

Applicants must have had sound training in the testing and maintenance of protective gear.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale: £965/£1,090 p.a., Grade L.13. N.J.B. Conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, The North Western Electricity Board, 40-41 Lune St, Preston, and returned to him by 14 Aug., 1961. (B 518)

TEST ASSISTANTS

for transformer and motor test departments. Young men aged 23-30 with suitable background and experience will be considered for further training. Staff position. Commencing salary about £13 10s per 42-hour week. Apply stating age, experience, qualifications and present salary to: Personnel Manager, Fuller Electric Limited, Walthamstow, E.17. (B 517)

WHIPP & BOURNE LTD.

of Castleton, nr. Rochdale,

have a few vacancies in permanent pensionable positions for

DRAUGHTSMEN

Applicants should have a minimum qualification of O.N.C. and have good experience in a.c. and d.c. marine and industrial switchgear.

The factory is on the main A664 road between Manchester and Rochdale and there are excellent diesel and bus services between Castleton and surrounding towns, including Manchester. There are possibilities of promotion in the future after experience with the company.

Applicants should give brief details of age, qualifications and experience. They should be sent in writing to the Chief Draughtsman, Whipp and Bourne Ltd., Castleton, Rochdale, Lancs. (B 504)

Eastern Electricity

Northmet Sub-Area

ENFIELD DISTRICT

GENERAL ASSISTANT ENGINEER

(Ref. 1064)

174/61.R.

Candidates should have had a good general and technical education and possess the Higher National Certificate or an equivalent qualification.

Salary: N.J.B. Class H, Grade 13, £765/£870 plus £50 London Allowance.

Apply by letter to A. T. Durbridge, Manager, Eastern Electricity Board, 40 Church St, Enfield, Middlesex, by 18 August, 1961.

Chilterns Sub-Area

HEMEL HEMPSTEAD DISTRICT

TWO THIRD ASSISTANT ENGINEERS

177/61.RN.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

An application for the allocation of housing in the New Town will be made for the successful candidates, if required.

Salary: N.J.B. Class G, Grade 9, £965/£1,090.

Apply by letter to the Manager, Hemel Hempstead District, Eastern Electricity Board, Bridge St, Hemel Hempstead, Herts, by 18 August, 1961. (B 543)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Project Group

THIRD ASSISTANT ENGINEERS

Applications are invited from suitably qualified engineers for the following appointments in project design teams at Finchley:

Third Assistant Engineers (Electrical)

Third Assistant Engineers (Mechanical)

Candidates should preferably be members of an appropriate professional institution or possess qualifications leading to membership, and should have experience in the design, manufacture, installation or operation of modern power station plant.

The duties will include the preparation of specifications, assessment of tenders and general supervision of contracts.

Salaries for these appointments will be in accordance with Scale 13 of the National Joint Board Agreement, i.e., £1,320/£1,610 per annum, according to qualifications and experience, plus £60 per annum London Allowance.

Applications stating age, qualifications, experience, present position and salary, should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires La, Finchley, London N.3, to arrive not later than 16 August, 1961.

Envelopes should be marked "Confidential, Ref.: S/61/16."

T. YULE,
Chief Project Engineer.
(B 535)

ELECTRICIANS REQUIRED

in Slough area. Apply, stating age and experience, to:

C. A. J. Billington Ltd.,
Cranfield, Bletchley,
Bucks.

Vehicle will be provided for senior man appointed. (B 548)

ELECTRICAL INSTALLATION DESIGN STAFF

Consulting Engineer requires additional staff in Electrical Department to assist on design of electrical installations in buildings of various types, industrial, commercial and educational. Contracts mainly large and interesting including many which have been prominent in the National Press.

Two grades required:

a. Trainee draughtsman aged 16-18 (background education should include some technical training or suitable G.C.E. subjects). Facilities will be given for attendance at Daytime Technical Course.

b. Junior electrical engineer/draughtsman with O.N.C. or equivalent.

Good salaries will be paid in accordance with experience and benefits include luncheon vouchers, etc. Write, stating age, experience, technical background and salary required to:

G. H. BUCKLE AND PARTNERS,
2 Harrington Gdns, London S.W.7.
(B 549)

ELECTRICAL ENGINEER

Preferably with induction heating experience to handle technical and commercial aspects of this type of equipment. This position offers a young engineer, aged 25-30 an opportunity to gain experience and eventually accept responsibility and build up his own department.

There is also a possibility of visiting Sweden to obtain further experience and knowledge in this field.

Apply stating age, experience, qualifications and present salary, to: Personnel Manager, Fuller Electric Limited, Fulbourne Road, London E.17. (B 516)

CHIEF ESTIMATOR

Should be experienced in estimating electrical contracts up to £100,000 and capable of finalising same. H.N.C. or final year. Pension scheme. Five-day week. Apply, giving details of experience and salary expected to:

Nisbet Patfield and Co. (Electrical Engineers) Ltd.,
41 Merry St,
Motherwell, Lanarkshire.
(B 547)

KUWAIT OIL COMPANY LIMITED

require

TWO ASSISTANT ELECTRICAL ENGINEERS for service in KUWAIT

Applicants should be in the age range 25-35 and be in possession of the Higher National Certificate in Electrical Engineering or equivalent qualification and should have had extensive experience of power system operation and of the maintenance of switchgear, transformers (with automatic on-load tap changing equipment), underground and overhead distribution up to 66 kV, modern protective equipment and automatic control gear. Experience in the problems associated with interconnecting transmission between power stations is also desirable.

Whole local salary will be dependent on qualifications and experience, but will not be less than £2,430 per annum. Kit allowance of £85 is payable. There is no tax on personal incomes in Kuwait.

Write for application form, giving brief details and quoting K.2807 to:

Box D/53, c/o Hanway House, Clark's Place, E.C.2. (B 526)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Project Group
GENERAL ASSISTANT ENGINEERS
(DRAWING OFFICE)—MECHANICAL

APPLICATIONS are invited for appointments as General Assistant Engineers (Drawing Office) Mechanical, in the Midlands Project Group's Drawing Office, at Bournville, Birmingham.

Candidates should possess a sound practical and technical training and be working towards a suitable professional qualification. The salary will be within either Grade 12, Scale 8, £920/£1,165; Grade 13, Scale 7, £840/£1,090; or Grade 15, Scale 5, £690/£940 per annum in accordance with the National Joint Board Agreement.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham 30, and should be returned to him not later than 14 Aug., 1961.

Envelopes should be endorsed "C.E.G.B. Staff Confidential, No. MPG.51/61." (B 512)

THE NORTH EASTERN ELECTRICITY BOARD
Wear Sub-Area

APPLICATIONS are invited from suitably qualified engineers for the appointment of

THIRD ASSISTANT ENGINEER
SUB-AREA ENGINEER'S STAFF
OPERATION AND MAINTENANCE SECTION
SUNDERLAND

The successful applicant will be required to assist with the operation and maintenance of h.v. and l.v., overhead and underground distribution networks and substations, up to and including 66 kV.

Salary: Schedule A, Class L, within Grades 10-11, £1,115/£1,325 per annum. Conditions of service in accordance with the National Joint Board Agreement.

It is not necessary for applicants to previous advertisements for above appointment to re-apply.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (B 529)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division
Vacancy No. 245/ET/61.

APPLICATIONS are invited for the superannuable N.J.B. appointment of
FOURTH ASSISTANT ENGINEER
in the Efficiency, Testing and Combustion Section of the Generation Department at Divisional Headquarters, Cardiff.

Salary: Schedule A, Class J, Grade 11, Scale 7 (£890/£1,090 per annum).

The section is concerned with acceptance and routine tests and investigation into safe and efficient operation of all power station plant within the Division.

Candidates should possess at least a Higher National Certificate in mechanical or electrical engineering. Previous experience of power plant operation and testing are desirable, but not essential, and a knowledge of instruments and electronic circuitry would be an advantage.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 19 Aug., 1961. (B 546)

ASSISTANT ELECTRICAL ENGINEERS with at least H.N.C. and two to three years' experience of E.H.V. transmission work required by Consulting Engineers in their Contracts and Design Department, Weybridge. Applications stating age, qualifications, experience and salary required to Kennedy and Donkin, 12 Caxton St, London S.W.1, quoting ref.: RWMc. (B 277)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ARMATURE WINDER required with experience of machines up to 100 h.p. Ideal opportunity for young, skilled man to establish a permanent position and gain further experience. Apply in writing, giving age, experience and present wages to the Works Employment Officer, Fuller Electric Ltd., Fulbourne Rd, Walthamstow, E.17. (B 502)

BIC (SUBMARINE CABLES) LTD. require a CABLE DESIGN ENGINEER, aged 25-35 years, having an Electrical Engineering Degree, H.N.C. or equivalent qualifications, to undertake electrical cable designs and specifications, and preparation of technical data for tenders for Submarine Cable Scheme. Staff pension scheme. Canteen and social club facilities.—Applications should be addressed to the Secretary, BIC (Submarine Cables) Ltd., Trafford Park, Manchester 17. (B 525)

B.B.C. requires an ENGINEER in the Transmitter Unit of Planning and Installation Department based in London. Applicants (British Subjects only) should be qualified engineers, preferably having an engineering degree or its equivalent. The work consists of planning and carrying out installations on M.F., V.H.F. (Sound and Television) and U.H.F. transmitting stations and includes experimental investigations on new equipment and liaison with equipment manufacturers during the design and production stages. Practical experience in the above field is not essential, but candidates should have an interest in current technical developments and a knowledge of techniques employed in modern transmitting and receiving equipment. Ability to write clear and concise reports, etc, would be an important asset. Commencing salary £1,380 p.a. to £1,540 p.a. according to qualifications and experience in a scale with a maximum of £1,780 p.a. Write for application form to Engineering Recruitment Officer, Broadcasting Hse, London W.1, quoting reference 61.E.169. (B 514)

CONTRACTORS who specialise in overhead line and cable laying contracts require YOUNG ENGINEERS with experience and initiative.—Apply Box No. 8385, Electrical Times. (B 550)

ELECTRICAL DRAUGHTSMAN required for plant work in medium sized factory. Knowledge of factory distribution, control layouts and low tension work generally. Apply to Labour Manager, Enfield Rolling Mills Ltd., Millmarsh La, Brimsdown, Enfield. (B 552)

ELECTRICAL ENGINEER. The North British Rubber Company requires an Electrical Engineer, aged 30-40, to take charge of the Department and be responsible to the Chief Engineer for the supply, application and maintenance of all electrical plant (5,000 kVA); candidates must have served apprenticeship and have had at least five years' experience in a factory, including supervision of labour and selection and installation of plant; a generous salary will be offered to the selected candidate who must possess at least H.N.C. in Electrical Engineering. The Company operates a contributory superannuation scheme and provides free life assurance. Assistance will be given with removal expenses. Applications giving full particulars and present salary should be addressed to Industrial Relations Division, The North British Rubber Co. Ltd., P.O. Box 47, Castle Mills, Edinburgh 3. (B 542)

ENGINEER required to take charge of maintenance staff responsible for electrical and mechanical plant in a group of Maltings in Oxfordshire/Wiltshire area. Plant consists basically of motors, conveyors, elevators, lighting, etc. Previous experience of planned maintenance as applicable to continuous manufacturing process essential. Salary £1,000 per annum plus modern rent-free house. Three weeks' holiday and superannuation scheme. Applications stating age, experience and qualifications to Barlow, Leslie and Coombes, Consulting Engineers, 5 Catherine Pl, Westminster, S.W.1. (B 519)

ESTABLISHED Electrical Engineering Concern engaged in manufacturing and repair of electric motors and transformers require qualified ELECTRICAL ENGINEERS for staff appointments in United Kingdom. Age limit 37. Good conditions. Applications stating training, qualifications, experience, present position to Box No. 8375, Electrical Times. (B 469)

SENIOR and JUNIOR ELECTRICAL ENGINEERS required for London Consulting Engineers' office for installation design of industrial, commercial and educational buildings. Apply stating age, experience, training and salary required to Box No. 8377, Electrical Times, or 'phone Welbeck 3564. (B 470)

SENIOR TRANSFORMER DESIGNER with experience of various types up to 5 MVA. This appointment carries a very realistic salary and scope for the future for the right man between 30-40. A company house is available if required. Factory is situated in ideal rural surroundings four miles from the sea. Apply Chief Designer, London Transformer Products Ltd., Bridgend, Glam. (B 362)

APPOINTMENTS WANTED

GRADUATE ELECTRICAL ENGINEER, with considerable industrial experience, wishes executive position in light electrical or electro-mechanical manufacturing concern of repute. Financial interest required.—Box No. 8367, Electrical Times. (B 406)

WANTED

CLEAR OUT YOUR REDUNDANT PLANT. We are the best buyers of surplus DIESEL GENERATING SETS, DIESEL ENGINES and MARINE ENGINES. Up to 5,000 h.p. Top price paid. We dismantle and remove. Send details to Messrs. D. Arnold, Feltham Rd, Ashford, Middx. Phone Ashford 3349. (B 527)

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (B 1)

EDUCATIONAL

GUARANTEED COACHING for City and Guilds Examinations—Electrical Engineering Practice, Electrical Installation Work and Illumination Engineering. Also many practical non-examination courses. No books to buy.—Write for FREE prospectus stating subject to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. (B 513)

MIDDLESEX COUNTY COUNCIL
Education Committee
TWICKENHAM TECHNICAL COLLEGE
EGERTON ROAD, TWICKENHAM, MIDDX
Principal: J. P. WOLFENDEN, M.SC., M.I.E.E.
SPECIAL LECTURE COURSES
ELECTRICAL FLOOR WARMING AND HEAT STORAGE

Eleven evening lectures, 7 p.m. to 9 p.m. commencing Tuesday, 26 Sept., 1961. During the course three different electrical floor warming systems will be laid at the College. Fee £1.

PRINTED CIRCUIT TECHNIQUES

Twelve evening lectures 7 p.m. to 9 p.m. commencing Friday, 22 Sept., 1961. During the course printed circuits will be produced by different methods. Fee £1.

BASIC NUCLEAR MEASUREMENTS

Laboratory course of eight meetings:
Course A, 2 p.m. to 5 p.m.
Course B—6.30 p.m. to 9.30 p.m.

Brochures and application forms are available from the Principal. Telephone: POPesgrove 6656. (B 551)

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FOR SALE

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS. Switchgear, Exhaust Fans, Hoists, Reduction Gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (B 2)

A.C. AND D.C. MOTORS, Generators, new and reconditioned. REWINDS and repairs promptly executed.—Service Electric Co. Ltd., Honeypot La, Stanmore. Middx. Edgware 5566. (B 8)

A.C. AND D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (B 7)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/4. Stores at Chobham, Surrey. (B 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (B 6)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment. — Universal Electrical, 221 City Rd, London, E.C.1. (B 3)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (B 4)

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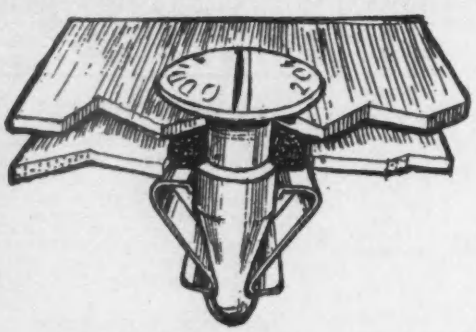

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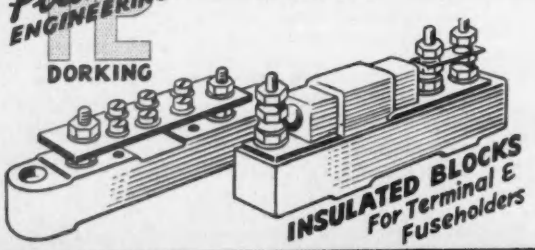

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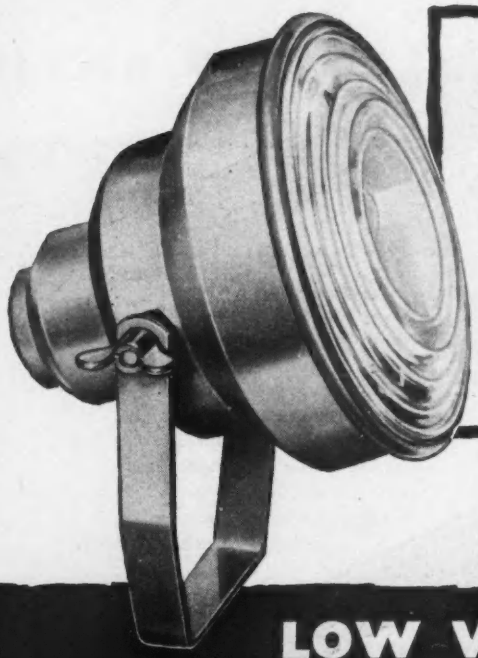

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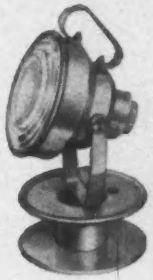

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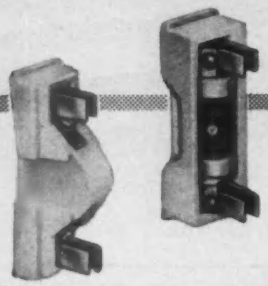

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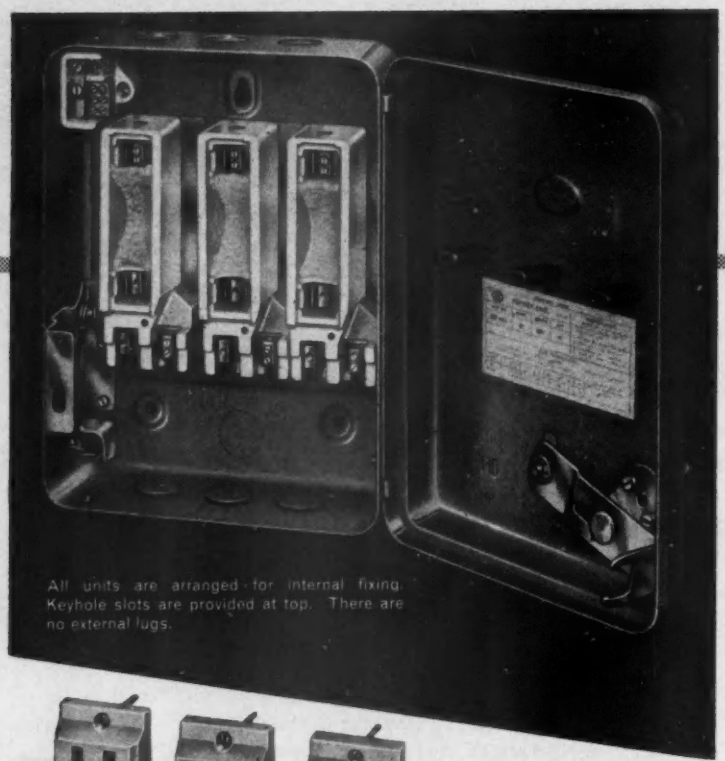
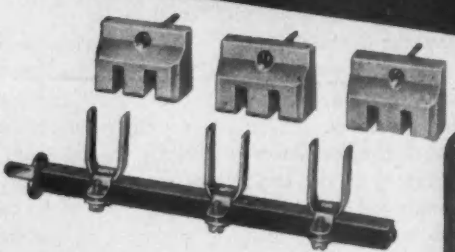


All units are arranged for internal fixing. Keyhole slots are provided at top. There are no external lugs.



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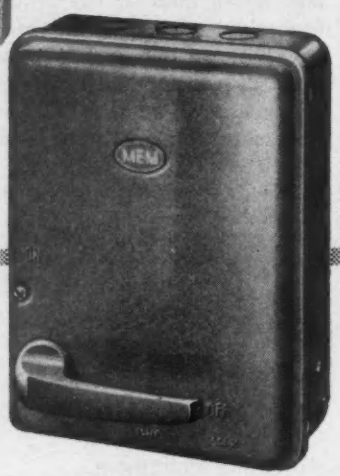

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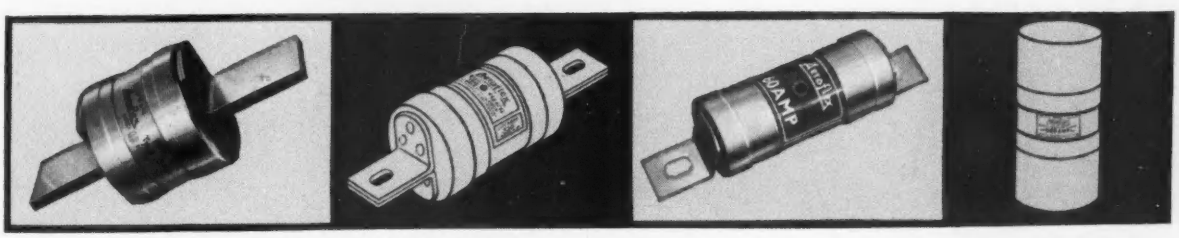

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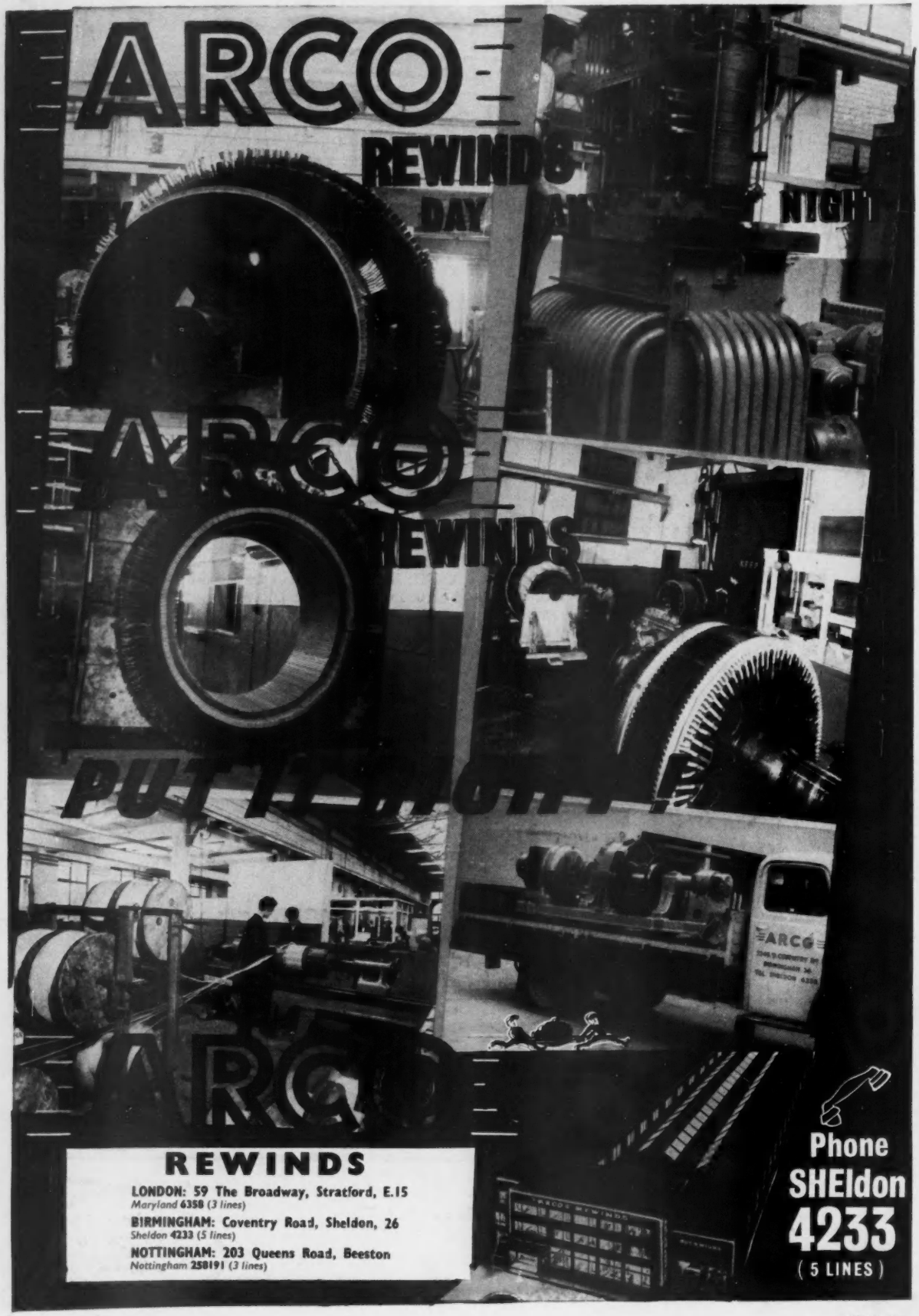
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